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THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE
INSTITUTE OF BRITISH FOUNDRYMEN AND THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION.

Institute of British Foundrymen.

PRESIDENT, 1924-25, R. O. Patterson, Blaydon-on-Tyne.

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Secretary: F. J. Griffiths, 20, Fisher Street, Swansea.

The Fluidity of Metals.

It is generally assumed that the fluidity of liquid metals and alloys is a function of the temperature—the higher the temperature the more fluid the liquid. There are cases, however, when this assumption fails, and it is necessary to look for other factors.

Perhaps a reference to the manufacture of basic electric steel affords the best illustration, as, after all, it is a process of which the control is most exact. It is a common experience when handling this process to find that a highly fluid yet dead steel loses its "life" if it is kept in the furnace for some time after having reached the best conditions for casting. Mr. Poole has stated that he has found that absence of "life" can be ascribed to a granular type of non-metallic inclusion. Is the metallurgist then justified in assuming that after casting temperature has been reached the steel is capable of incorporating as simple solution particles of the hearth or perhaps—though less likely—the slag? One would imagine, of course, that any particles detached from the hearth would immediately rise to the top and become incorporated with slag, owing to the difference in specific gravity. However, though there is no definite scientific evidence to show it, our practical experience has convinced us that there is no sharp separation between liquid steel and slag-like impurities. We believe that this could be proved by dephosphorising a ten-ton bath of basic electric steel until a universally accepted figure of 0.008 per cent. phosphorus was reached, and opening a tap hole, situated at the lowest part of the bath and teeming, say, five tons into a clean hot phosphorus-free furnace and instituting reducing conditions, using only phosphorus-free slag materials. We feel convinced that a final figure of at least 0.013 per cent. phosphorus would be found. It is worthy of note that electric furnace baths at slagging time are very hot, but whether high temperature is a necessary factor for the institution of conditions favourable to the solution of non-metallic impurities still requires more evidence.

In cast iron the absence of life is particularly noticeable when kish is present. It therefore seems that if the presence of non-metallic impurities does affect the life of liquid metals and alloys, they do so by forming a series of centres from which freezing can take place and so hinder the equalisation of heat, which apparently is necessary to keep the liquid "lively." It can be assumed that the non-metallic aggregations will have a lower heat conductivity. A further thought is that the presence of non-metallic inclusions in some cases may increase the conductivity of the lining of the ladle by forming an intimate contact with a material capable of reacting with it. For instance, if the inclusions were of a limey character, they could flux ganister or fireclay, thus forming a different and more intimate contact from normal.

It seems to be essential that the inclusions must have a higher melting-point than the alloy, for it is fairly well established that such an inclusion as phosphorus in cast iron increases the "life" of the liquid.

The whole subject is difficult, and explanations are almost invariably based on unproved assumptions, but we believe that the theory that "life" is affected by the presence of non-metallic inclusions will be accepted by many technical men, and that their efforts to prevent such incorporations will have a beneficial effect on the product in the future.

Trade Talk.

The Sheffield Branch of the Associated British Machine Tool Makers, Limited, has been removed to Orchard Chambers, Church Street, Sheffield.

The Pneumatic Engineering Appliances Company, Limited, 14, New Burlington Street, London, W.1, have removed to Donnington House, Norfolk Street, Strand, W.C.2.

Mr. Ed. Brand has removed his offices and showroom from 96, Victoria Street, Westminster, London, S.W.1, to 48 and 49, Adam Street, New Kent Road, London, S.E.1.

The deliveries of North African iron ores by the Mokta-el-Hadid Company during the first half of the current year totalled 293,000 tons, compared with 299,500 tons in the first half of 1923.

Mr. Geo. W. Owen, iron and steel agent, who has represented the Earl of Dudley's Round Oak Works, Limited, for upwards of 30 years, has removed to 60, King Street, Manchester.

Mr. B. Kelly will conduct a course of lectures on iron and steel at the City of London College, White Street, Moorfields, E.C.2, arranged specially for the need of men in export houses. The course will begin on September 30.

The periodical audit of the books of the employers in the pig-iron trade in Scotland under the Conciliation Board agreement brings out the average net selling price at £4 19s. 11d. per ton. This entails a reduction in the wages of the workmen of 1 per cent. on basis rates.

Samuelson & Company, Limited, engineers and machinists, Britannia Works, Banbury, have appointed Mr. Frank Carter, of 43, Parsonage Chambers, 3, The Parsonage, Manchester, as their representative in Lancashire, North Cheshire, and the West Riding of Yorkshire.

James Bennie & Sons, Limited, Clyde Engine Works, Govan, Glasgow, have in hand the reconstruction of their works, which were recently badly damaged by fire. The Armstrong Construction Company, Limited, Germiston Works, Glasgow, have the contract for the erection of the buildings.

Thos. W. Ward, Limited, the well-known iron, steel and engineering firm of Sheffield, have acquired the Bolton works of H. Bessemer & Company, Limited, and it is not likely the works will be run again. In all probability they will be dismantled and sold in various directions. Comprised in the plant are Siemen's furnaces, steam hammers and forge equipment, rolling mills, locos, cranes, railway sidings, machine tool, axle and pattern-shop equipment, etc., etc.

Personal.

Mr. Oliver Smalley is now paying an extended visit to the United States of America and Canada.

Mr. W. S. Hill, J.P., of Redcar, works manager for Dorman, Long & Company, Limited, has retired after 35 years' active association with the industry. At a comparatively early age he received the appointment of ironworks manager, and later became a director and manager of Walker, Maynard & Company, Limited. When Dorman, Long & Company, Limited, acquired that undertaking Mr. Hill became blast-furnace manager, and subsequently took charge of the coke oven plant in addition. He is a member of the Cleveland Ironmasters' Association.

Dr. Leslie Aitchison, consulting metallurgist of Birmingham, has given up his practice to take up a position as assistant to Mr. Horace W. Clarke, the managing director of James Booth & Company (1915), Limited, of Argyle Street, Birmingham. The firm are a subsidiary of Vickers, Limited, and are the sole manufacturers of the light alloy "Vickers' Duralumin," besides doing an extensive business in the manufacture of the usual non-ferrous metals. Dr. Aitchison has had a wide and varied experience, having been consultant metallurgist to the Air Ministry for a number of years, and also acted in the same capacity for the Association of Drop Forgers and Stampers. He is a Doctor of Metallurgy at Sheffield University, and was for several years on the staff of his University. Officially, he will act as superintendent of the company.

Wills.

Soar, A. B., wire and metal worker, Hendon	£14,685
Laporte, B. F., chairman and governing director of B. Laporte, Limited ...	£76,637
Sterne, L. S., founder of L. Sterne & Company, Limited	£60,240
Douie, A., of North Lodge, Walkergate, Newcastle-upon-Tyne, shipyard manager, late of the Walker Shipyard, of Sir W. G. Armstrong, Whitworth & Company, Limited	£9,183

Obituary.

Mr. Henry Reece, chain manufacturer, of Colley Gate, Cradley, died on July 23.

Mr. Wm. Stewart, of Upper Waun Street, Blaenavon, died recently at the age of 38. He was assistant traffic manager to the Blaenavon Company, Limited.

Mr. Edgar Windsor Richards, the well-known metallurgist, of Edgar Windsor Richards & Company, Limited, 10, Long Acre, London, W.C.2, died on August 5.

Mr. Wm. Woodbridge died recently at his residence, Harlan Lodge, St. Stephen's Road, Bath, at the age of 79. The deceased gentleman was the founder of the firm of Woodbridge & Company, agricultural engineers, 6, Long Acre, Bath.

Mr. J. G. Reay, of Hagley, died recently. He was a well-known figure in commercial circles in Birmingham and the Black Country. Mr. Reay, who was 79 years of age, was the head of the firm of Guest & Company (Halesowen), Limited, manufacturers of nuts and rivets, of Hales Owen.

Mr. J. Whitfield died recently at Milton Grange, Moseley, Birmingham, at the age of 76. The deceased gentleman was chairman of James Whitfield, Limited, brassfounders, Oxford Street, Birmingham, and of Whitfields Bedsteads, Limited, Watery Lane, Birmingham, and a director of the Lanchester Motor Company, Limited.

Mr. D. H. King died recently at Broomhill Home. He was the eldest son of Mr. David King, of David King & Sons, Limited, Keppoch Iron Works, Possilpark, Glasgow. Eleven years ago the deceased, while on business for the company in Aberdeen, was knocked down by a motor-cyclist and had his spine injured, from which he never recovered.

Company News.

Indian Copper Corporation, Limited, 6, Queen Street Place, E.C.—£225,000 in 2s. shares.

F. A. Greene & Company, Limited, 29, Bartholomew Close, E.C.—Capital £6,000 in £1 shares, Ironfounders.

Bradmore, Limited, engineers, 5, Lee Street, Bradford.—Capital £1,000 in £1 shares. Directors: N. Bradley and J. E. Moore.

J. Samuel White & Company, Limited.—Profits, £331; brought forward, £1,551; half-year's preference share dividend to October, 1923.

J. & D. Croft and Sons, Limited, galvanisers, Springfield Works, Wollescote, near Stourbridge.—Capital £25,000 in £1 shares. Directors: J. Croft, D. Croft, H. B. Croft and H. D. Croft.

Charles Parker, Sons & Company, Limited, Victoria Foundry, Dundee.—Capital £10,000 in £1 shares. To acquire and take over the undertaking of Charles Parker, Sons & Company, Victoria Foundry, Dundee.

Shot and Abrasives (Amalgamated), Limited, 10, Albert Road, Middlesbrough.—Capital £3,000 in 1,500 10 per cent. participating preference and 1,500 ordinary shares, all £1 each. To acquire the business now carried on by A. T. Snodgrass. Merchants. Directors: A. T. Snodgrass and G. Pettigrew.

Gazette.

The Luton Iron Foundry Company, Limited, are being wound up voluntarily. Mr. J. F. P. Baxter, 244, High Holborn, London, W.C.1, has been appointed liquidator.

The Scottish Stamping & Engineering Works, Limited, have presented a petition to wind up the Lancashire Ordnance Accessories, Limited. The petition is to be heard at Manchester on August 6.

J. & D. Croft, Limited, are being wound up voluntarily with a view to reconstruction. Mr. E. Bosley, 120, Colmore Row, Birmingham, is the liquidator. The new company is named J. & D. Croft & Sons, Limited.

A receiving order has been made in connection with the affairs of Mr. F. Clews, 27, Oakfield Road, Erdington, trading as the Vauxhall Aluminium Manufacturing Company, 148, Francis Street, Vauxhall, Birmingham.

Contracts Open.

Johannesburg, August 23.—Steam roller. The Department of Overseas Trade, 35, Old Queen Street, London, S.W.1.

London, S.W., August 22.—Steam travelling cranes, etc., for the South Indian Railway Company, Limited, 91, Petty France, Westminster, S.W.1.

Wallasey, August 11.—100 tons Sandberg silicon rails, B.S.S., for the Corporation. The Borough Engineer's Office. Mr. G. Livsey, town clerk, Town Hall.

Pioneer Foundry, Blaydon-on-Tyne.

This company, of which Mr. R. O. Patterson, the President of the Institute of British Foundrymen, is a director, was established in the year 1870 by Mr. Thomas Smith, but was reconstructed in the year 1897. It is now one of the largest producers of rail-chairs in the United Kingdom, and has recently started a new rail-chair foundry, which department employs about 100 men.

This foundry is 130 ft. long by 187 ft. wide, and the roof is of the saw-tooth type, arranged for north-light, which affords an ample supply of light. The shop is divided into nine bays, seven being of approximately 17 ft. span, whilst the remaining two are of 34 ft. span. For casting purposes, each bay is served by a system of overhead bulb-rail runways, which in turn connect with a main overhead bulb-rail at the west-end of the shop and running at right-angles to the bays, which main rail is in direct communication with the cupolas.

Melting Plant.

The whole of the foundry is kept supplied with molten metal by two cupolas which occupy a building at the north-west end of the moulding shop.

Fig. 1.—Loading Up Pig-Iron, which is Automatically Weighed, by the Side of the Metal Bed.—Smith, Patterson & Company, Limited.

These furnaces were built by J. W. Jackman & Company, Limited, of Manchester, and are of the usual drop bottom type, being provided with six tuyeres. The height of each is 40 ft., with a diameter (inside of lining) of 56 ins. Each cupola has a melting capacity of about 12 tons per hour. The furnaces are charged mechanically by means of a skip-bucket apparatus operating on the mono-rail trolley system, two balanced elevators being used to hoist the loaded skips to the charging floor level. Each charging bucket is suspended from an automatic scale which constantly indicates the load being carried. Instead of having to load first and weigh afterwards on a fixed scale, the weighing is done automatically while the bucket is being filled. The charges are dumped alternately into hoppers on opposite sides of the stack, and are thus correctly distributed in the cupola. These hoppers shoot the charge directly into the cupola, the ordinary charging door being eliminated.

Four charging buckets operate on the mono-rail system, there usually being two on each track serving the opposite sides of the cupolas independently. The charging buckets are used for the handling of pig-iron, scrap and limestone only. The coke, which is generally Priestman's or the Marley Hill Chemical Company's, is weighed on a W. T. Avery weighing machine, and is sent up to the charging platform in wheelbarrows, from which it is dumped into the cupolas.

A fan, furnished by James Keith & Blackman Company, London, supplies the blast. This fan is driven by a 40-h.p. motor, giving 2,300 r.p.m.

When the metal in the cupolas is molten, it is allowed to run into a cap-shaped receiving ladle of 30 cwt. capacity, equipped with tilting gear. Owing to the shape of the ladle, the stream of metal need not be stopped while the casting ladle is being filled, and, therefore, the large ladle acts as a mixer as well as a receiver. The casting ladles, when full, are taken back along the overhead runway to the particular bay for which they are required. One ladle follows another, and the foundry is kept supplied with hot metal throughout the day.

Sand Preparation.

The old sand is used over and over again, being strengthened with about 10 per cent. of new Erith loam and sufficient coal-dust is added to ensure a good skin on the casting. The sand-mixing department contains a plant which mixes, mills and conveys the sand to each bay of the chair shop. This plant consists of a pan mill, of the usual type, in which the sand is milled, a mechanically-operated gyratory riddle and a bucket elevator in which the prepared facing sand is hoisted to the distributing gallery, which runs down one end of the foundry just over the bulb-rail system. The sand is discharged through a gyratory riddle into the muller and then through a hole in the pan of the latter into the boot of the bucket elevator. At one end of the distributing gallery is a hopper into which the elevator discharges. From this hopper the sand is let out by an attendant into a light buggy, which is utilised to keep the moulders' hoppers filled. Each bay is provided with one of these hoppers, which are made of wood with cast-iron bottoms. They extend from the distributing gallery to the floor, and are about 12 ft. in height, with a 24-in. cross-section at the bottom and a 24-in. by 38-in. section at the top. These hoppers are always kept full, and there are between thirty and forty tons of sand used per day in this foundry alone. The rail-chair foundry operates continuously, and casts about 100 tons per day.

Fig. 2.—Coke Barrow and Coke Weighing Machine.—Smith, Patterson & Company, Limited.

The Jobbing Foundry.

At the extreme western end of the yard there is a foundry which is reserved for jobbing work. This shop is about 300 ft. long by 40 ft. wide, and is fitted with a 3-ton electric travelling crane by John Smith (Keighley), Limited, and two small hand cranes. There are also two coke-fired core stoves.

The Sand Slinger.

In the middle of the foundry there is a Beardsley-Piper sand slinger moulding machine of the tractor type machine, with a radius of 9½ ft. It travels into the sand heap under its own power, collecting the sand from the floor by means of a right- and left-hand sand-cutting screw-conveyor, which conveys the sand to the centre of the machine, where it is elevated by means of a bucket elevator and deposited on to the screen of an

oscillating riddle. The riddle is so constructed that scrap, gagger, cores, etc., which are in the sand, will stay on stop of the screen and work to the front end where they are deposited into a chute and then into the scrap box, which is mounted on the main arm.

The riddled sand is conveyed by the oscillating

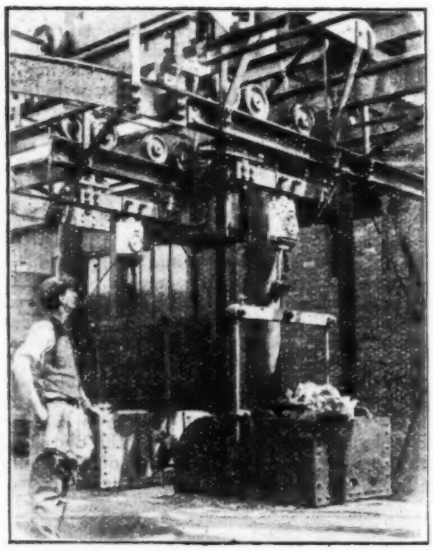


Fig. 3.—View of the Overhead Change Rails by means of which Empty Skips are Removed from Cage and Loaded Ones Run In.—Smith, Patterson & Company, Limited.

riddle into a hopper mounted on the impeller arm, above a belt that conveys the sand into the impelling head, which discharges the sand with centrifugal force into the mould at the rate of 10 cub. ft. of rammed sand per min.

The ramming capacity of this machine can be regulated by the speed at which it is fed into the sand heap. The operation of this machine is very simple, and a labourer can be taught it in a few hours. Castings up to 30 cwts. are made in this foundry, and, with a very few exceptions, are all made in green sand.

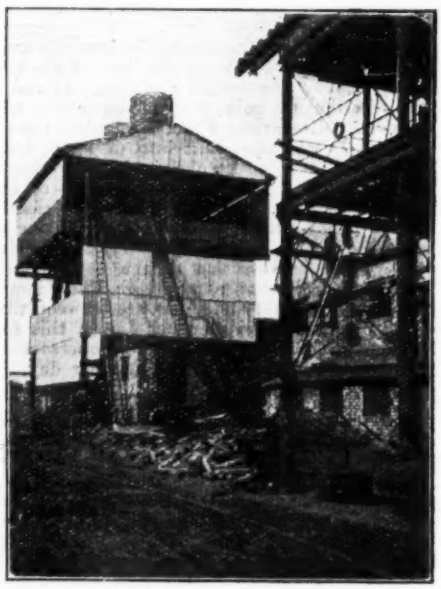


Fig. 4.—View of Cupola Plant.—Smith, Patterson & Company, Limited.

The Old Chair Shop.

This is at present being transformed into a general jobbing foundry. A sand-mill with smooth-faced rollers has quite recently been installed. At one end of the foundry there is a small crucible steel furnace, blast being supplied by a small fan. The firm makes steel castings up to about 2½ cwts.

The Large Foundry.

This foundry is divided into two bays. The larger of the two is used for turbine work, and is 185 ft. by 45 ft., being served by two electric

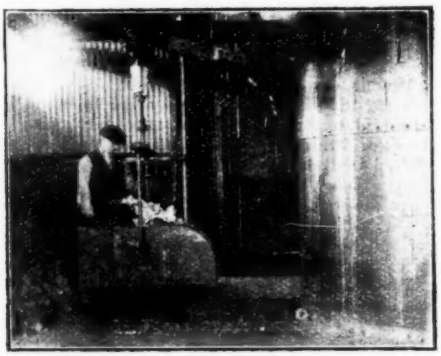


Fig. 5.—Loaded Skip Ready to be Discharged into the Cupola Chute.—Smith, Patterson & Company, Limited.

cranes of 20-ton and 15-ton capacities respectively and two hand-cranes of 1-ton capacity. At the end of this bay there is a new cupola in course of construction. When complete, this furnace will have a melting capacity of 12 tons per hour, and will be used for supplying the foundry with molten metal for castings up to about 20 tons. For castings from 6 to 7 tons, the metal is, when possible, obtained from the two cupolas in the new chair foundry. The casting ladles being brought along the bulb rail system which extends throughout the works. There are two large moulding pits in the centre of the large bay, which are used for turbine castings.

The smaller bay is 160 ft. long by 40 ft. wide, and is served by a 10-ton electric crane. At one end of this bay there are two core stoves. The

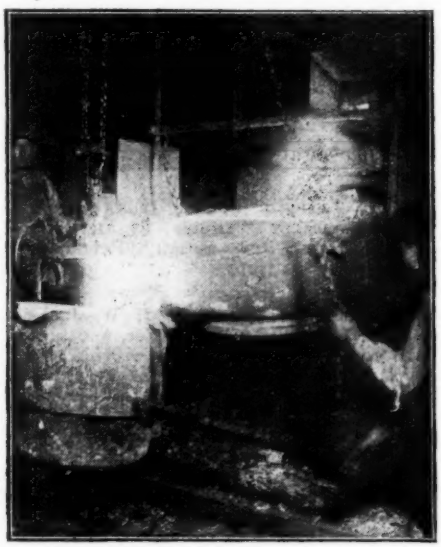


Fig. 6.—View of Tapping Side of Cupola, showing Receiver Ladle and Casting Ladle.—Smith, Patterson & Company, Limited.

sand is mixed by means of a gyratory sand riddle, and dry sand, green sand and loam moulding is carried on in this foundry.

Other Cupola Plant.

On the west side of the yard, there is a cupola with a melting capacity of 3 tons per hour. This furnace was almost entirely constructed by the firm and has eight tuyeres. Instead of the usual blast belt there is a pipe round the circumference of the furnace.

On the south side of the works, there are two cupolas of a melting capacity of 10 tons per hour,

but these are very seldom used now. They each have seven tuyeres, and were remodelled by the firm, who replaced the solid bottoms by drop bottoms.

The Jubilee Foundry.

There is still another foundry, which is known by the name of the "Jubilee Foundry," part of it having been built on Jubilee Day. It is used for general jobbing work, axle boxes for railway work, etc., and segments for underground railway tubes. The foundry is divided into four bays. At the north end there is a jar-ram machine for repetition work in fire-bars, etc. This foundry can be adapted to repetition work largely if necessary.

In addition to the foundries, there are the fitting, machining and blacksmiths' shops, which are all under one roof.

The firm does not do very much machining, and the above shop is mainly used for their own constructional work, but, however, they are quite capable of machining castings up to a certain size if necessary. In the case of very large turbines, such as the Parsons' type, the castings are cleaned in the foundry, but the customer does the machining.

The machine shop is served by a 7-ton crane by Royce, Limited, and is provided with the necessary lathes, planing and drilling machines. All the machines in the works, with the exception of the jib cranes and two locomotives in the yard, are driven by electricity. One of the travelling cranes is of 5-tons capacity, whilst the other is 3 tons, and these, together with the two locomotives, are driven by steam.

There is also a small brass foundry and a pattern shop, the latter containing the necessary equipment of lathes, band saw, planing machine and circular saw.

There is also a testing house, which contains a 30-ton Avery testing machine. Rail chairs have to stand 19 ton direct thrust on centre of rail bed without fracture, the chair resting on its base upon supports 12 in. apart. The firm's average for these chairs is between 24 and 25 tons. This machine is also worked by electric power, but there is also a hand machine for ordinary test bars, etc.

A well-equipped laboratory is provided, and the mixtures are made up by analysis.

The works have a good river frontage, and the river is of convenient depth to allow the firm's steamship, "Pattersonian," to lie out at the jetty. This ship is principally employed in carrying the firm's raw materials and manufactured products between coastwise ports. On the jetty there is a 3-ton electric crane.

The works are also connected by sidings to the North-Eastern Railway. The raw material is taken in at one end of the yard and the finished castings pass out at the other end. The firm makes all descriptions of castings up to 20 tons.

During the recent Convention in Newcastle this works was included in the list of works visited.

Chromium-Plating Steel.*

BY KEVIE W. SCHWARTZ, Columbia University, New York City.

The property of metallic chromium of retaining its silver-like lustre indefinitely, even in a chemical laboratory, is typical of the corrosion resistance of this metal. Its resistance to certain unusual corrosives, as for instance certain molten metals, is even more remarkable. It is not surprising, therefore, that chromium plating has been studied for many years. But the reports of previous investigators fail to agree on many important points.

After eliminating many solutions and methods of procedure as unsatisfactory, a series of runs was made, varying the concentration of the chromic acid, but keeping the content of chromium sulphate and the current density constant. It was found that good deposits could be got on iron, using chromium anodes, anywhere within the range from 200 to 400 grammes per litre of chromic acid. The best concentration was found to be 245 grammes per litre chromic acid, plus 3 grammes per litre chromium sulphate, which solution was designated as "C."

* Extracted from a Paper presented to the American Electro-Chemical Society.

Good Deposits Obtained.

Using this solution, the effect of current density was determined over the range from 2.7 to 54 amp. per sq. dm. (25 to 500 amp. per sq. ft.). Good deposits were obtained up to about 16 amp. per sq. dm. (150 amp. per sq. ft.). Above this the deposits were dark at first, and after continued plating showed signs of cracking. The best current density to use for a bright adherent deposit proved to be between 10.8 and 13.4 amp. per sq. dm. (100 and 125 amp. per sq. ft.), with the electrolyte at room temperature.

In the successful experiments a single cell was used. This consisted of a 600-c.c. beaker with two anodes (usually chromium) suspended in the solution, preferably by means of chromium-plated iron wires. The anodes of chromium were prepared by the Goldschmidt process. They were approximately 5 × 3.7 × 3.7 cm. (2 × 1.5 × 1.5 in.) in size. The chromium sulphate and chromic acid used were Eimer & Amend's "chemically pure grade." All solutions were filtered before using. Cold chromic acid solutions have little or no effect on the filter paper. The iron cathodes were electrolytically cleaned.

Exposure for weeks to the corrosive atmosphere of the laboratory produced no effect on the chromium plate, whereas iron corroded rapidly. Chromium-plated iron immersed in tap water for three weeks showed no signs of losing its lustre or of a tendency to corrode. Dipping the chromium plate into hot sulphuric acid or hydrochloric acid caused it to dissolve. Boiling it in hot concentrated nitric acid for two hours produced no appreciable effect on the chromium plate.

Experiments showed that chromium does not stand up under electrolytic corrosion nearly as well as it does under atmospheric corrosion. Of the materials tested—namely, chromium-plated iron, ordinary iron, aluminium and Duriron—the last showed smallest loss due to electrolytic corrosion.

Under the microscope the chromium plate is uniform and free from holes due to occluded gases. Chromium plate has wearing qualities and hardness superior to ordinary iron, galvanised iron and tinned iron. Chromium-covered iron is not attacked by molten tin, zinc or brass, whereas ordinary iron disintegrates rapidly.

Conclusions.

1. Good, adherent deposits of chromium on iron were obtained, using solutions containing 3 grammes per litre chromium sulphate and from 200 to 400 grammes per litre chromic acid.

2. The cathode current density range for good deposits was found to be from 9.3 to 16 amp. per sq. dm. (100 to 150 amp. per sq. ft.).

3. Best results were obtained using Sargent's solution containing 3 grammes per litre chromium sulphate, 245 grammes per litre chromic acid, and a current density of 13.4 amp. per sq. dm. (125 amp. per sq. ft.). The anodes used were chromium. The solution was at room temperature, and stirring in addition to that caused by the evolution of hydrogen was found unnecessary.

4. Chromium anodes in the above solution show no tendency to become passive even after long and continuous plating operations. Chromium anodes are cheaper than platinum and better than lead.

5. The simultaneous evolution of hydrogen with chromium deposition on iron is essential to good results. The hydrogen appears to protect the freshly discharged metal and to counteract the great tendency of chromium to pass back to the chromous iron stage. This tendency is particularly marked in the strongly oxidising medium of chromic acid.

6. Chromium-plated iron and steel has a hard, bright, silver-like surface.

7. Chromium-plated iron and steel resist atmospheric corrosion indefinitely.

8. Chromium-plated iron and steel are resistant to the action of fumes of nitric acid, hydrogen sulphide and ammonia. They also resist the corrosive action of molten tin, zinc and brass.

9. Steel does not lose its temper during chromium plating.

10. Chromium-plated iron does not resist electrolytic corrosion in mineral acids.

"Body."

By J. Kent Smith, O.B.E.

It is probable that in steel and iron practice no term has been used more loosely, or with less discrimination and understanding, than has the term "Body." Too often has it formed the rock upon which the practical worker in the industry and the applied scientist have split, and it is with some trepidation that the writer invades contentious territory. But there is no real need for the pronouncements of either party to be at variance. It is a truism that there can be no effect without a cause; it is the business of the scientist to determine the cause which produces an effect in a given set of empirical conditions, and by devising suitable means of control to secure the reproduction of that effect in a totally different set of industrial conditions. And this communication is an honest effort to reconcile conflicting views. That there have been, and are, conflicting views is not to be wondered at; both schools have always discussed the question as though "body" were a positive entity, and something which wittingly or unwittingly had been put in during manufacture. In the writer's opinion this point of view indicates almost as great a misconception of facts as does that utterance of a Scottish steel master—now almost a classic; some 25 years ago he is recorded as having said to his works manager, "Sheffield is making a great fuss over putting Sorbite into her steel; where do you buy this Sorbite?"

We know Sorbite to be an induced and arrested transformation or phase; "Body," on the other hand, is an entity, but a *negative* entity. In other words, it is not necessarily due to the presence of something, but rather to the absence of something else. That something else is not of necessity one simple thing—it might consist of more than one—but where the iron is to act as an intermediate for the ultimate manufacture of steel there can no longer be reasonable doubt but that one thing hugely preponderates in determining the excellence of performance ascribed to "Body"; its effect, however, is not elementary, and *everything may depend upon how it is combined.*

Popular Definition of "Body."

No thoroughly satisfactory definition of what exactly is implied by the designation "body" in connection with steel or iron has been advanced; the term would best be interpreted as indicating that inherent property of an iron which causes its ultimate product to perform its service function repeatedly without deterioration, and renders that product less susceptible to the deleterious actions of many of those conventional poisons which undoubtedly, in other circumstances, would exercise very pronounced and well-proven ill-effects upon it. To draw an analogy, "body" in an iron may be said to be akin to stamina in a human being; training may intensify its visible effect just as suitable fabrication and treatment may bring out the best in a steel. But in both cases the seeds of that best must be there, and to look for them we must go right back to the conditions of birth. Leaving the analogy at this point and restricting ourselves to consideration of steel, want of stamina in it should be looked for—naturally assuming correct practice in fabrication—in the blast furnace itself.

Functions of Blast Furnace.

The functions of this useful piece of industrial apparatus may roughly be divided into three, each merging more or less into the other. The topmost zone of the (vertical) furnace brings about expulsion of the volatile constituents of the charge, and its heating to the temperature necessary for reaction. In the next zone reduction proper takes place. In the third—contiguous at one end to the tuyeres—we have melting of the reduced iron in intimate contact with tuyere-gases and with the further products of reduction of some of the non-ferruginous components of the charge. The melted and degraded iron collects in the well of the furnace, whence it is tapped and separated by gravity from molten slag. It is of more than passing interest to note that the blast furnace was not originally designed—at its inception some seven hundred years ago—for the purpose of making what we now know as "cast iron," but with the sole idea of industrialising on a larger scale of output something already existent, *i.e.*, the Catalan forge and the Stückofen. The ironworker up to that period had been accustomed to his product being weldable, malleable and tenacious; the product of the first crude blast furnace was (and of the present highly developed instrument is) unweldable, non-malleable and more or less brittle and "short." We know this product now to be an alloy of iron with the products of its blast-furnace environment.

The Puddling Process and Body.

The trend of further operations was thus naturally in the direction of restoration of ductility, etc., to the blast furnace product; by successive stages through the centuries we have arrived at modern processes of steel making wherein pig-iron is the main intermediate. The first of these stages was the discovery that, on treating the remelted product of the blast furnace with excess of iron ore, grains of metal were precipitated from the bath which had all the *visual* characteristics of the iron to which the worker previously had been accustomed. The stage substantially persists to-day in the conduct of the puddling process of manufacturing wrought iron; in that process the expression "coming to nature" is used by the workman to denote a certain critical step in the procedure, and the origin of the expression is self-evident from what has already been said.

In fine, after the adoption of the blast furnace, practical work in dealing with its melt was mainly directed towards the removal of impurities which had been introduced in the furnace. And this is precisely where the trouble as regards "Body" lies. Removal of those impurities which visibly change the nature of iron itself was successfully accomplished. *But that impurity introduced in the blast furnace which modified materially for the worse the inherent stamina of the iron was neglected utterly.* As blast furnace practice and procedure was "improved" more and more of this impurity was introduced, and the "Body" of the steel made from its product became less and less. The impurity was combined-nitrogen, which is introduced to iron in the blast furnace via a "cyanogen reaction." And no system of steel making—short of special after-treatment with denitrogenising alloys, which even then function only in equilibric quantities—can rid iron of nitrogen once combined with it; where freedom from dissolved nitride is imperative the sensible way is completely to prevent, by regulating conditions of environment, etc., when reducing the iron, the formation of nitrogen compounds such as can react with and go into solution in iron. If conditions be such that some of this denitrogenising compound be formed, but its "decomposed nitride" be fixed as a comparatively harmless inclusion, we still retain "Body"; this is best done at or immediately after birth, *i.e.*, in the blast furnace itself.

If we review in order some conditions of iron-smelting it leaps to the eye that the very set which make for low content, and reasonably complete fixation, of nitride are present in the making of those irons which notoriously possess in the highest degree (the property termed) "Body." As the conditions of iron manufacture tend more and more towards increase of nitride formation and the direct solution of that nitride in the iron itself, so does "Body" become less and less apparent either in the iron or in its subsequent product, conditions as to measurement and judgment being equal. The writer opines the very general admission that, of irons produced at the

present day, it would be difficult to find one with more "Body" than the iron resulting from the smelting and refining of middle-Dannemora ore by the Walloon process. In making such iron the "charcoal" cold-blast furnace is worked at an exceedingly low-temperature; the slag is siliceous, manganiferous, and contains relatively little lime; and the ore itself is naturally and amply provided with a nitrogen-fixing element. We thus have the minimum amount of cyanogen compound formed, the minimum absorption by the dropping iron of what *is* formed (on this point the monumental work of Professor J. A. Leffler, of Stockholm, should be referred to), while the majority of the cyanogen compound that is formed and absorbed is either slagged away or fixed as a harmless inclusion. Next we can take into consideration those Swedish irons which result from the operation of the "charcoal" blast furnace (worked at somewhat higher temperatures) upon briquetted ores; in these the production of cyanogen compound is somewhat greater than in the first named, conditions of its absorption are relatively increased, and much of the nitrogen-fixing element of the ore has been discarded in ore-concentration. Subsequently in order of "Body" come irons resulting from the smelting of pure English ores in the charcoal-fired cold-blast furnace; next comes iron resulting from the smelting of similar ores in the coke-fired cold-blast furnace. It should emphatically be noted that increased area of absorption of tuyere-gases and elevation of furnace hot-zone temperatures both result from the substitution of coke for charcoal. As the blast supply is heated, and gets hotter progressively, the resultant iron has less "Body" still, and it is under such conditions as these that the production and absorption of cyanogen compounds in the furnace is further increased.

Relationship between Nitrogen and Body.

When we couple with these considerations the observed facts, already detailed in some measure by the writer in previous communications to THE FOUNDRY TRADE JOURNAL, that fixation of nitrogen by means of vanadium has materially increased those characteristics ascribed to "Body," and that in F. M. Beckett's hands fixation of nitrogen by means of zirconium has wonderfully ameliorated forging and rolling conditions in the case of high-sulphur steels, the balance of circumstantial evidence becomes materially weighted. When further notation is made of the detailed experiences of the writer as to the remarkable virility, and the immunity from poisoning by conventional impurities, attaching to solid-produced irons—made from the most ordinary raw material—into which no nitrogen could have been introduced, his argument appears further to be supported. To crown all, when one considers possession by classic irons of "Body" *in excelcis* and the fact that they were made, from very excellent raw materials, by processes which completely precluded the introduction of nitrogen, it would appear that absolutely direct relationship must exist between solution of nitride content *in the iron itself* and "Body."

The term denotes a very real attribute; not one contemptuously to be dismissed by a scientist—who does not carry his science far enough—as indicating some visionary fabric intangible as "that stuff from which dreams are made," but rather one to be regarded by him as resting upon a real scientific foundation.

Vickers, Limited.—Payment on August 14 of dividends on preferred stock and preference shares for half-year to June 30; no dividend on ordinary for 1923, balance of £98,728 available after payment of preference dividends being added to amount brought in, giving carry-forward of £802,635.

United States Steel Corporation.—The United States Steel Corporation's earnings and dividends in the second quarter of the current year (and of last year) were as follows:—Total earnings, $41,381,000 ($47,858,000); net earnings, $28,610,000 ($34,828,000); dividend on preferred, 1¾ per cent.; and on common ¼ per cent., with an extra ½ per cent. Surplus for the quarter, $8,575,000 ($7,205,000 last year).

Book Review.

Corso di Fonderia, by Alfredo Galassini. Published by Societa Tipografico Editrice Nazionale (S.T.E.N.) Turin, Italy. Price in Italy 80 lire, but subject to augmentation.

The author of this book on foundry practice is the Professor of Engineering at the Royal Polytechnical College at Turin, but from the manner in which he deals with his subject one would have assumed that he was a well-informed foundry manager. It consists of 688 pages and is both well illustrated and indexed, there being close on 800 line drawings and reproductions from photographs. In Chapter I the professor deals with the metals used in the foundry, and since he includes sections on contraction, blowholes, pipe, it will be realised that no detailed study is included. Chapter II is devoted to melting plants—the crucible, cupola and reverberatory types—and perhaps devotes too much space to patents which have never been generally employed in practice. Raw materials other than metals, are dealt with in the following chapter, whilst Chapter IV is devoted to runners and risers, venting and hydrostatic pressure. After devoting a section to patterns, the author deals in Chapters VI to IX with hand moulding and describes both the sand and loam methods. His work on art moulding is extremely interesting and is more complete than in any text book we have seen printed in English. "Permanent Moulds," "Malleable Cast Iron" and "The Manufacture of Cast Iron Pipe," are translations of the captions of Chapters X to XII. Practically the next half of the book is devoted to machine moulding, only the last chapter—No. XIX, which deals with fettling, sand blasting and welding. There is a distinct lesson to be learnt from the author's description of moulding machine methods. It is obvious that the most important system used in Italy is the hydraulic method, but what is still more significant is that no "out and out" British moulding machines appear to be used. French, American and German figure very largely, yet the transport costs are not in all cases higher than they would be from England. For foundrymen who can read Italian, they will find much to interest and instruct them.

Foundry Queries.

Moulding Rain Water Pipes.

Offers of help have been received from Messrs. G. Rawden & Son, Paragon House, St. Andrew's Crescent, Cardiff, Mr. J. Shepherd, of Glenfield, near Leicester, and Mr. John I. Clark, of 14, Wigan Road, Ormskirk, Lancs.

Catalogues Received.

Mechanical Gas Producers.—We have received from Messrs. Wellman, Smith Owen Engineering Corporation, Limited, of 36, Kingsway, London, W.C.2, a 16-page catalogue printed on art paper describing the Wellman mechanical gas producer. It contains a mass of both practical and technical information. We understand that it is now available for the metallurgical trades. It is actually section V, part X of the firm's general catalogue.

Drying Stoves.—The Foundry and Engineering Company, Albion, West Bromwich, have sent us three folders dealing with mould, core and sand drying stoves respectively.

Forced Draught Furnaces.—Messrs. Meldrums, Limited, of Timperley, Manchester, have sent us a 24-page booklet entitled, "Through the Furnace Door." It contains a novel feature in as much as it asks recipients to fill in daily the fuel and water consumption of their boilers, and submit the figures to the senders, who in turn will report on the efficiency of the plant.

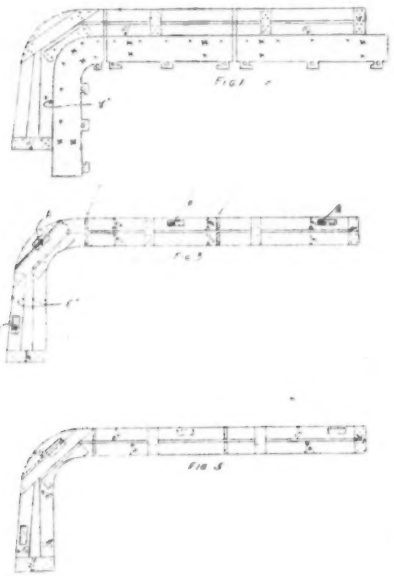
Cast Iron Pipes.—The monthly stock list of cast iron pipes for August, issued by The Staveley Coal and Iron Company, Limited, is now available.

XUM

The Production of a Large Steel Casting.

By H. V. Fell.

The author has been much impressed in recent years by the scarcity of Papers dealing with the manufacture of steel castings, especially those describing the moulding operations for castings of the larger type. The object of this article is, therefore, to describe an example of this class of work as carried out by a large British firm. The subject chosen may appear somewhat difficult to the ordinary moulder, but with a little thought and care this can be overcome by the method explained.



Making the Tackle.

To facilitate these operations a template should be provided to the outline of the pattern. This is marked off to suit the making of the different tackle. It will be noticed at this stage that the work on hand is to be divided into three sections. This is to enable the job to be more easily handled during the subsequent stripping, drying, assembling, and easing operations.

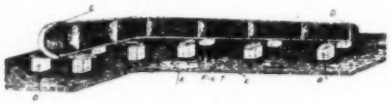
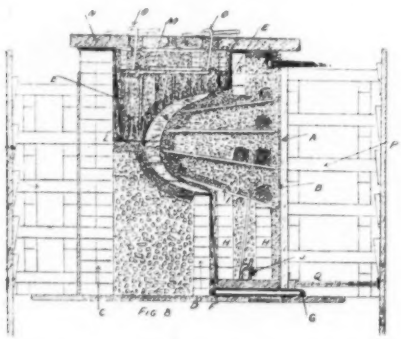
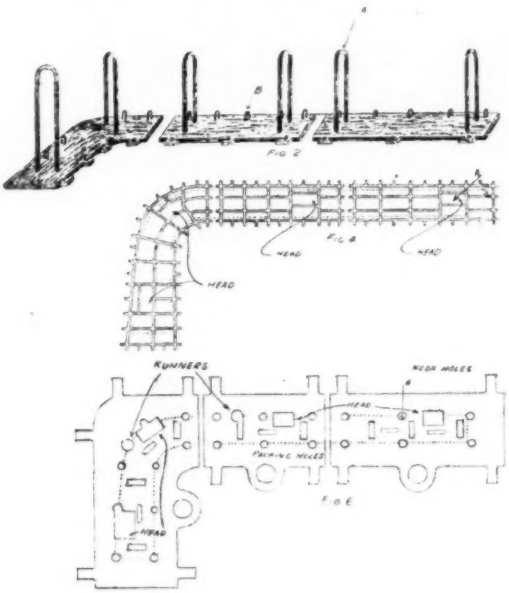


Fig. 1 shows the template marked off for the making of the drawback templates. The square holes are for the bars A, which support the plates B, Fig. 8, and the large X, the position of the lifting eyes A, Fig. 2. The small x shows the position of small staples which hold the straight irons I, Fig. 18. Fig. 3 shows the template marked off for the making of the grids, Fig. 4. These carry the gaggers, etc., of the top-parts, and show the position of the feeding heads or risers at A, Fig. 3.

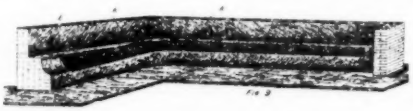


Moulding.

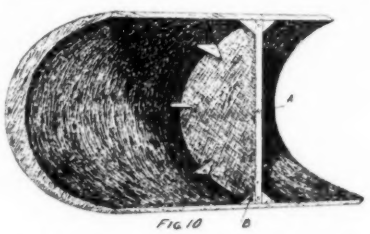
The first object of the foreman or moulder entrusted with the following operations is to prepare a pit suitable for the job on hand—that is, if there is not one already in the foundry. Then, having done this, care should be taken to place immediately below the pattern suitable plates, as shown at A, Fig. 7. These plates not only provide a good foundation for the work on hand, but prevent steam ascending from the earth below during the drying process, thus causing cracks to appear on the face of the mould.



After this has been done, the pattern is placed into position on a base of brick and wood, as shown at B, Fig. 7, and the measurements taken for the walls C and D, Figs. 8 and 9. This can be done by holding a piece of weighted string to the side of the pattern, the inner wall D, Fig. 8, being built below the front part of pattern, and the outer wall C taken back about 10 in., to allow for the joint E of the top-parts, Figs. 8 and 9.



After these walls have been built up to a convenient height, the cavity betwen them is filled up with dry material, such as cinders, old bricks, old sand, etc., until approximately 4 in. from the pattern. The remainder is then rammed up in the usual way, with a facing composition backed with floor sand.



It now remains for the pieces of wood E, Fig. 7, which support the pattern, to be removed, and the spaces caused by their withdrawal also rammed up. The outer wall C, Fig. 8, is now continued

until completed. Then, having finished this, a tapered loam joint is made on the inner wall, as shown at F, Fig. 8. A loam bed is now made at G, Fig. 8, in which has been inserted small bars, such as fishplates or the like. These furnish a bearing for the drawback plates, on which are now built the walls H. These provide a foundation for the carrying irons I, Fig. 8.

These irons are made secure by means of S hooks to the staples J, Fig. 8, and are also weighted

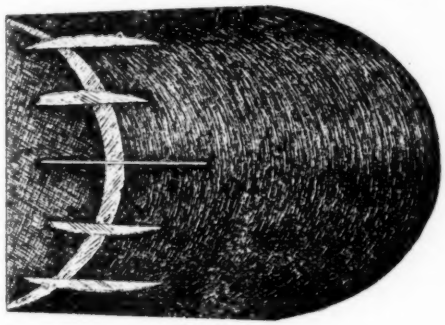


FIG. 11

with pieces of pig-iron to counter-balance the overhanging weight of the drawbacks. At the webs A, Fig. 10, small wooden brackets B are placed to prevent fractures at these points. The drawback is then proceeded with in the usual way until the interior is rammed up level with the top of the pattern, after which the wall K, Fig. 8, is

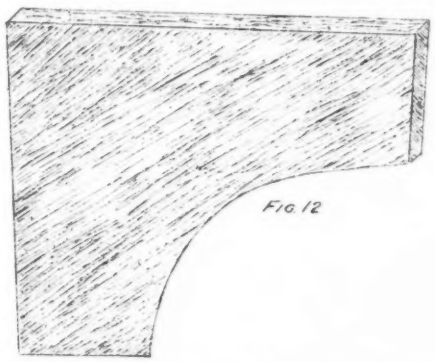


FIG. 12

built to complete the joint E for the top-parts. This is then given a covering of parting sand mixed with clay water, to prevent it from crumbling during the ramming up of the mould.

The top grids, runners, splitting boards, Fig. 12, and the pieces of wood which form the heads are placed into position—the grids with small pieces of wood underneath the prodders, to prevent them from cutting through on to the pattern. The gaggers L, Fig. 8, are then interlaced through the grids to carry the sand below.

Brackets are also placed on the outside position of the webs, as shown at Fig. 11. Then, having rammed up the sand, etc., to the top of the grids, the pieces of iron M, Fig. 8, which form the connection between the grids and the top-plate N, Fig. 8, are placed in position, and the ramming continued until level with the walls.

A layer of loam is now placed on these walls, on which the top-plates are bedded. Hooks are then inserted through the holes provided at A, Fig. 6; these are located under the grids, and the whole secured by means of wedges, etc., as shown at Fig. 8. Then, having completed this, the dividing-boards, heads, and runners are withdrawn, and the top-parts and drawbacks made

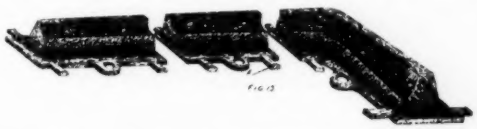


FIG. 13

ready for removal. This is carried out by means of slinging suitable chains on the lugs A, Fig. 13, in the case of the top-plates, and by means of a large beam, strong ropes, and S hooks, in the case of the drawbacks, Fig. 14. The whole of these parts are now finished off and stoved in the usual way.

All that now remains is the finishing off of the bottom part of the mould, Fig. 9. Brackets are placed at the position of the webs, and the run-

FIG. 14

ners cut at A. This portion of the mould is then dried by means of placing coal about the joints and base of the brickwork, the whole of which is then enclosed by means of old corrugated sheets, etc., and fired off.

Closing.

When sufficient drying has been allowed, the mould is made ready for re-assembling. However, before placing the drawbacks, etc., into position, the residue that has been left by the drying opera-

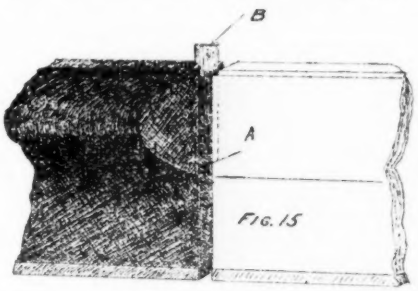


FIG. 15

tions is removed, and the bed on which the drawbacks sit carefully looked over to be certain that it is free from cracks. If there are any, these must be made secure, otherwise the metal may get away at these points.

The drawbacks are now placed into position in the usual way, and the dividing space A between

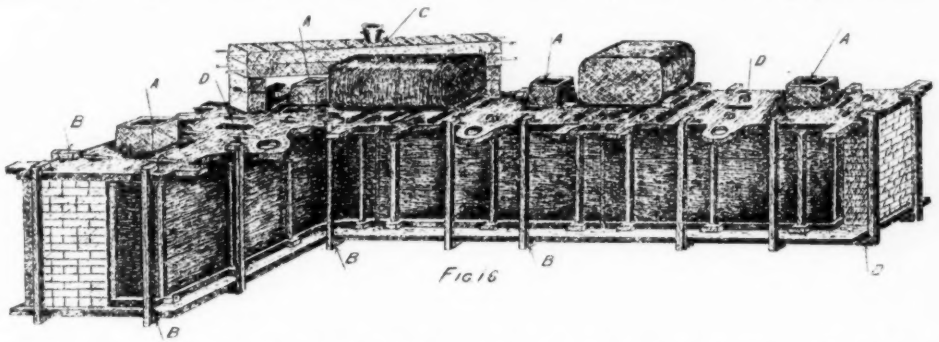
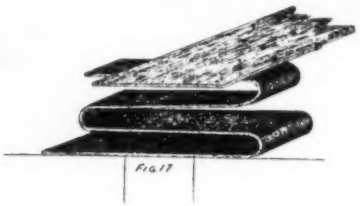


FIG 16

them at the back made up. This is done by inserting a suitable piece of steel plate B, Fig. 15, and ramming securely behind it. Any extra head allowance that is now desired is added by means of ramming up small boxes, as shown at A, Fig. 16, after which the end top-parts are placed into position, and provision is made for the dividing spaces. This is carried out by means of inserting a flexible

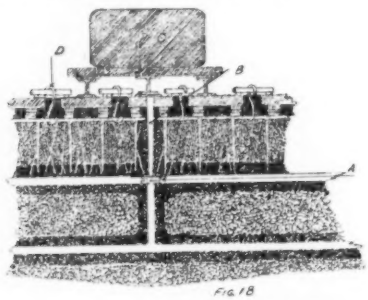
piece of sheet steel-plate underneath the top parts, and held in position to the contour of the mould by springers, Fig. 17. This arrangement is made so that the pieces stand out sufficiently for the centre top part to sit on, as at A. The space B is then rammed up and weighted, as shown at C, Fig. 18.

All the different portions of the mould now being located, they are clamped and weighted, as



shown at Fig. 16. The runners, etc., should then be placed in position, and the sides of the job shored up. It is of importance, however, that the drawback plates be shored up with steel packing, as at Q, Fig. 8, the remaining parts of the drawbacks and outer walls being held in position, as shown at P, Fig. 8, with lengths of wood.

The mould is now ready for the metal. However, the job should be carefully examined before casting. After the casting operation has been carried out, the metal is given a short period in which



to solidify, after which the runner and head boxes, weights, etc., are removed from the top plates, and the hooks, O, Fig. 8, released.

This done, the shores P and Q, Fig. 8, are taken away, as well as the top and drawback plates. The casting is then released, or eased, by taking away the cinders, etc., between the webs, thus allowing the casting to contract between the points C and D, Fig. 7, after which the outside walls, grids, etc., are removed, and the casting allowed to cool completely.

Hacksaws and Bandsaws.

An anonymous writer in "Machinery" gives some practical hints as to the economical use of hacksaws and bandsaws. After pointing out there is little difficulty as to the upkeep of the actual machines, the author states that the clearance desired in hacksaw blades consists of top, front and side. If insufficient top clearance is provided, long life is impossible. Insufficient front clearance prevents rapid cutting, as sawing then practically becomes scraping. Lack of side clearance causes heating up and undue wear, and is also apt to draw the temper of the teeth.

The effect of using teeth of an unsuitable size makes itself evident by lack of efficiency and speed in cutting when the teeth are too fine, and breakage when too coarse. A fine tooth saw will undoubtedly stand more rough hard usage. Thickness in blades is often undesirable, as sufficient set is more difficult to obtain in this case. While thin blades usually cut more quickly, if thinness is carried to excess they lack endurance.

The speed of traverse should be approximately 60 ft. per min. for tool steel and about double this figure for mild steel and iron, using a cutting compound. Cast iron is cut without lubricant, and the speed should be 80 ft. approximately.

Pressure is even more important than speed, as the former is more or less constant, while the latter varies, even through the use of a new blade against an old one, the latter requiring added pressure. It is difficult to recommend an exact working pressure, as this varies with the make of blade, material being cut, and speed of traverse.

As a rough guide, the figures in Table I are given. For mild steel 3-in. dia., starting with 40-lb. weight, to be gradually increased, as the blade dulls, to 50 or 60 lbs. This will be suitable for a well-built machine and a heavy grade blade. For lighter machines and light blades the weight should be decreased, but in no case below 20 lbs.

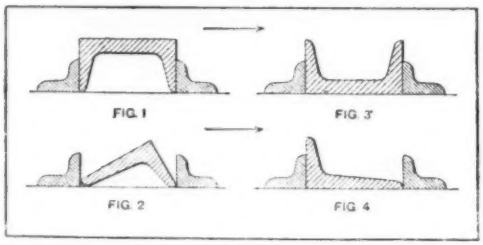
For cutting brass and other non-ferrous metals

Table I, Giving Number of Teeth Recommended.

Hand Blades.		Power Blades.	
14 teeth ..	For soft steel, cast iron and general work.	10 teeth ..	For all heavy work.
18 teeth ..	Tool steel, hard metals, light angle iron.	14 teeth ..	For all-round. light power work.
24 teeth ..	Brass, copper, iron pipes, sheet metals.	18 teeth ..	For iron pipe, brass and copper.
32 teeth ..	Very thin sheet metal and tubing.		

the use of a new blade is recommended, to be first used at a higher speed, and then possibly used up (when dulled) on iron and steel. A point that is often neglected is to see that the cutting compound is applied in the right place. Unless it is directed into the cut, but ahead of the blade, the life of the saw will be substantially reduced.

The most rapid and efficient work can only be obtained from a well-built machine, and one that is free from vibration caused by bad foundations.



Furthermore it is important that more than one speed is available as in other metal cutting machines. The tendency is to run the machine at a medium speed, when for very hard stock, the machine is being forced, whilst for brass the output is substantially reduced.

Working Hints.

Breakages are caused in working by using light blades on heavy machines; over-staining; dropping the blade too suddenly (drop the blade carefully on the return stroke); by starting a new saw in an old cut (as the set is always greater in a new blade, turn the work over and start from the other side); too much pressure. Saws so slack in tension that buckling is possible will always break.

The way the work is held in the vice will affect the output and the life of blades. Figs. 3 and 4 show, just by, the wrong way of fixing. The channel and angle should have their points downwards, because this obviates a tendency to damage the saw in starting. Light cuts with new saws require low pressure, but after use the pressure can readily be increased.

In Fig. 1 is shown the correct way of holding work of channel section. The angle iron in Fig. 2 will cut through in less time as the average amount of blade in the cut is greater and the vertical distance to be cut is less. This permits the machine to work nearer to its maximum capacity.

MR. F. BROOK, a director of Gledhill Brook Time Recorders, Limited, Empire Works, Huddersfield, died recently, at the age of 64.

Institute of Metals.

AUTUMN MEETING—LONDON.

The autumn meeting of the Institute will be held in London from September 8 to 11, by invitation of the local members of the Institute. It is hoped, especially as the meeting is to be held during the period of the British Empire Exhibition, that it will attract a large number of members, including many from overseas.

Programme.

MONDAY, SEPTEMBER 8.

2.30 p.m. to 8 p.m.—The office of the Hon. Local Secretary (Mr. A. H. Mundey) will be open at the Institution of Mechanical Engineers, Storey's Gate, Westminster, for the issue of tickets, badges, etc., and for general information.

8 p.m.—Third Annual Autumn Lecture, by Mr. W. M Corse, S.B., of the National Research Council, Washington, D.C., U.S.A., on "Recent Developments in Non-Ferrous Metallurgy in the United States, with Special Reference to Nickel and Aluminium-Bronze." Illustrated by kinematograph films and lantern slides.

TUESDAY, SEPTEMBER 9.

9 a.m. to 1 p.m.—The office of the Hon. Local Secretary will be open as above.

10 a.m.—General meeting of members in the Hall of the Institution of Mechanical Engineers, Storey's Gate, Westminster. In accordance with Rule 16 there will be presented a list of members nominated for election on the Council. A selection of Papers will be presented in abstract and discussed.

12.40 p.m.—The meeting will be adjourned until the following day.

1 p.m.—Members and their ladies will assemble in the large Banqueting Hall of the Connaught Rooms, Gt. Queen Street, Kingsway, W.C.2, for luncheon, by kind invitation of the local members, manufacturers, and business houses.

2.45 to 3 p.m.—Members and their ladies will proceed to the British Empire Exhibition. Admission tickets will be provided.

4 p.m.—Members and their ladies will be entertained to tea at the Regent Restaurant by the Local Committee.

WEDNESDAY, SEPTEMBER 10.

9 a.m. to 1 p.m.—The office of the Hon. Local Secretary will be open as above.

10 a.m.—General meeting of members in the Hall of the Institution of Mechanical Engineers. A selection of Papers will be presented in abstract and discussed.

2 p.m.—Members and their ladies will assemble at the office of the Hon. Local Secretary, and visits will be made to the following works:—(1) The Royal Arsenal, Woolwich; (2) the Royal Mint, Tower Hill; (3) Dewrance & Company, Great Dover Street; (4) Fry's Metal Foundry, Blackfriars; (5) J. Stone & Company, Ltd., Charlton Works; (6) United Glass Bottle Manufacturers (Charlton), Ltd.

7.50 p.m. for 8 p.m.—Members and their ladies will assemble at the National Physical Laboratory, Teddington, for a reception by invitation of the Director and Executive Committee of the National Physical Laboratory, and the Local Committee of the Institute of Metals.

8 p.m. to 9 p.m.—Members and their ladies will be received by the Director, Sir Joseph Petavel, K.B.E., D.Sc., F.R.S., and the President of the Institute, Professor Thomas Turner, M.Sc., A.R.S.M.

THURSDAY, SEPTEMBER 11.

9 a.m.—Trip to Windsor. Those members and their ladies taking part in the trip to Windsor will assemble at Waterloo Station, to travel by the 9.20 a.m. train for Hampton Court. Special saloons will be provided for the party.

9.54 a.m.—Arrive at Hampton Court. Thence by launch to Windsor. Luncheon at the Castle Hotel. Visit to Windsor Castle and Eton. Tea on board on return journey

Miscellaneous Information.

Railway Vouchers.—Railway vouchers entitling members and their friends to obtain return tickets from provincial stations to London and back at the specially reduced rate of a fare and a third will be posted to members who duly signify their requirements on the accompanying reply form. The availability of these tickets will be from Tuesday, September 2, to Monday, September 15 (both dates inclusive).

Communications.

The following communications are expected to be submitted:—

(1) "A Method for Measuring Internal Stress in Brass Tubes," by Robert J. Anderson, B.S. (Boston, Mass., U.S.A.), and Everett G. Fahlman, B.S. (Cleveland, O., U.S.A.).

(2) "The Application of the Ideal Solubility Curve to the Interpretation of Equilibrium Diagrams in Metal Systems," by D. H. Andrews and Professor John Johnston, D.Sc. (New Haven, Conn., U.S.A.).

(3) "Seventh Report to the Corrosion Research Committee of the Institute of Metals," by Guy D. Bengough, M.A., D.Sc., and R. May, A.R.S.M. (London).

(4) "Comparative Results on Copper-Silicon-Aluminium and Other Aluminium Alloys as Obtained on Separately Cast Specimens and Specimens Cut from a Crankcase Casting," by E. H. Dix, jun., M.E., M.M.E., and Lieut. A. J. Lyon, B.S. (Dayton, O., U.S.A.).

(5) "The Determination of Sodium in Aluminium," by D. M. Fairlie, M.Sc., and G. B. Brook, F.I.C. (Kinlochleven).

(6) "The Extrusion of Brass Rod by the Inverted Process," by R. Genders, M.B.E., B.Met., F.I.C. (Woolwich).

(7) "Investigation of the Effects of Impurities on Copper. Part II.—The Effect of Iron on Copper," by D. Hanson, D.Sc., and Grace W. Ford, B.Sc. (Teddington).

(8) "The Relationship between Tensile Strength, Temperature, and Cold-Work in Some Pure Metals and Single Solid Solutions," by Douglas H. Ingall, M.Sc. (Wednesbury).

(9) "On the Effect of Progressive Cold-Rolling on the Brinell Hardness of Copper," by H. Moore, O.B.E., D.Sc., Ph.D. (Woolwich).

(10) "Experiments on the Working of Nickel for Coinage," by Sir Thomas K. Rose, D.Sc., A.R.S.M., and J. H. Watson, M.C., B.Sc., A.R.S.M. (London).

(11) "Some Experiments on the Effect of Casting Temperature and Heat-Treatment on the Physical Properties of a High-Tin Bronze," by Francis W. Rowe, B.Sc (Manchester).

(12) "Some Experiments on the Influence of Casting Temperature and Mass on the Physical Properties of Admiralty Gun-Metal," by Francis W. Rowe, B.Sc. (Manchester).

(13) "Studies in the Aluminium-Zinc System," by Tomojiro Tanabe (Osaga Japan).

(14) "Metal Spraying and Sprayed Metal," by T. Henry Turner, M.Sc., and W. E. Ballard (Birmingham).

New Members and the London Meeting.

Only members and student members (with their ladies) will be entitled to participate in the London meeting (except that visitors may attend the reading of Papers). For the convenience of applicants for membership, who are desirous of being elected in time for the meeting, a special ballot is being arranged in connection with which membership application forms should be received by the Secretary not later than *noon on Wednesday, August 27*. The ballot will be concluded in time for members and student members so elected to participate in the meeting.

Members and student members are asked by the Council to do all in their power to increase the membership of the Institute, and to be good enough to convey this information to any of their friends who may be eligible for membership of the Institute, or to send the addresses of such friends to the Secretary, Mr. G. Shaw Scott, 36, Victoria Street, London, S.W.1.

The Austrian Magnesite Industry.—The Austrian magnesite industry is practically in the hands of two companies, namely, the well-known Veitsch concern and the Austro-American Magnesite Company at Radenthein (Carinthia). The latter's output represents about 40 per cent. of the total production of the country; and the bulk of it is exported to the United States as calcined magnesite. A new Austrian company is to be formed to take over the Austro-American concern.

The Analysis of Grey Iron Foundry Alloys.—II.

By H. H. S.

Graphitic Carbon.

The usual method of arriving at the amount of graphitic carbon—that of subtracting the percentage of combined carbon found by the Eggertz (colour) method from that of the total carbon determined by the direct combustion method, the difference representing the amount of graphite—is undoubtedly in every way the best method where the routine work of a grey iron foundry laboratory is concerned; in fact, it gives a result which is far more accurate than many results obtained by direct estimation of graphitic carbon. However, it is sometimes desired, for special or check work, to make a direct estimation; this can be rapidly and accurately carried out by the following method:—

Method Advocated.

Weigh off 1.0808 grammes of the sample into a 250 c.c. lipped tall-form beaker, cover with a cover glass, and carefully pour down the lip of the beaker 30 to 35 c.c. of 1 to 1 HNO_3. When the violent action subsides warm gently, avoiding boiling, until the metal appears dissolved. Now boil for 3 to 4 minutes to drive off nitrous fumes. Filter, by suction, through a thin pad of well-burnt asbestos wool, which is contained in a filter plate in a squat-form filter tube. To facilitate washing and removal of the pad, the body of the tube should not be too long—one measuring 2½ in. × 1 in. is a convenient size. Wash two or three times with cold 3 per cent. HNO_3, after having carefully transferred the graphite and silicon residue into the filter tube by the aid of a jet of hot water. When the nitric acid washings have run through, wash twice with water and 1 to 4 HCl, alternately; finally wash two or three times with hot water. Remove the pad and residue, taking care to wipe off any residue adhering to the tube sides; this is best done with a piece or wad of moist asbestos. The whole is then transferred to a combustion boat and dried in a hot-air oven. When dry, transfer the boat containing the pad, and residue is placed in the combustion furnace, and the determination completed exactly as described for total carbon.

Combined Carbon.

It is claimed by some analysts that the "difference" method, involving direct estimations of the graphitic and total carbon contents, is more accurate than the colour method for the determination of combined carbon. While this may be true when the assay is in the hands of a highly skilled analyst with plenty of time at his disposal, it is certainly not true, nor is it to be recommended, for ordinary foundry work. In the writer's experience, the colour method, when carried out by a normally careful chemist, gives results accurate to a degree far in excess of any variations in composition which can be controlled by the works practice, or of specification requirements. Further, it is an easy matter to train a junior chemist to estimate combined carbon by the Eggertz colour method to an accuracy of 0.01 per cent., provided that there is an insistence on strict attention to details.

For the determination, 0.2 gr. of the sample and the same amount of a standard are weighed in 6 in. × ⅝ in. *clean dry* test tubes; that the tubes should be quite dry is essential to accurate results, as damp tubes may cause fine particles to adhere to the side of the tube, and may be only partially attacked, or left unattacked, by the acid. The standard, used for comparison, should contain about the same percentage of carbon as is expected in the sample; a standard of 0.60 per cent. combined carbon can safely be used for samples containing 0.40 to 0.80 per cent.; that is to say, a minimum and maximum variation of 0.20 per cent. from the standard is permissible. Where an appreciable number of carbon tests are required daily, it is worth while to number each tube by etching with hydrofluoric acid; the practice of marking with gummed labels is unwise, as they often slip off under the action of the steam and water, creating uncertainty and much waste of time. The acid etching is clearly seen, and is permanent.

To each of the tubes containing the tests and standard 5 c.c. of 1.2 Sp.G. HNO_3 is added from a pipette or burette, they are placed in a bath of cold water, which is then heated to boiling. The tests are left in the water for 20 minutes (timed) after the water commences to boil, they are shaken at intervals of, say, 5 minutes, to aid driving off of nitrous fumes, and at the end of the boiling period are shaken again, removed from the bath, and cooled thoroughly to normal temperature. After cooling, the standard is filtered through filter paper-pulp contained in a ⅜-in. dia. filter tube, pressure being provided by the mouth, this method being more rapid than the use of small filter papers. The test tube is washed out with a little water, taking care not to "overshoot" the volume of solution. The filter tube is supported in a 30-c.c. capacity Eggertz or carbon tube graduated in c.c., so that the filtrate is received by it.

Hints on Comparing Colours.

The standard solution is carefully diluted with water to an exact multiple of its carbon contents; thirty times the percentage is a convenient working volume, a 0.60 per cent. standard being diluted to 18.0 c.c.; each c.c. will then equal 0.033 per cent. of carbon. The sample under test is filtered in the same way as the standard.

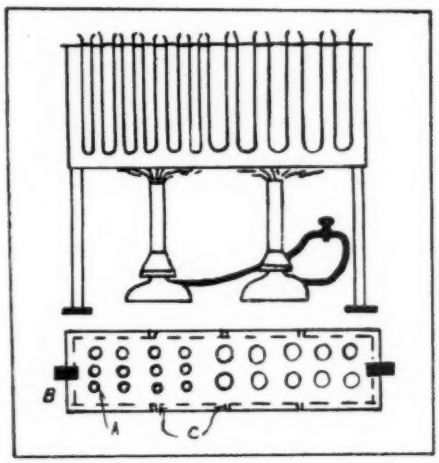


Fig. 7.—Carbon and Manganese Bath.

The carbon tubes employed should all be of the same kind of glass, which should be perfectly colourless; greenish- or pinkish-looking glass tubes should on no account be used; they should be of the same thickness, diameter, and capacity—in fact, in every way similar to the standard tube.

The two tubes containing the standard and a sample are held together, and a piece of moistened filter paper placed at the back; this appreciably aids the colour comparison, but the filter paper should not be too wet, or the draining water will reflect light and tend to give inaccurate results.

True comparison is obtained by diluting the sample until the colour intensity agrees with that of the standard. It is the colour-comparing part of the method which is often done in a slipshod manner, yet to secure accurate results one cannot be too careful when diluting to avoid "overshooting." The operator should hold the tubes in a position where the light striking them is evenly diffused. Every endeavour should be made to carry out carbon tests in daylight; artificial light—especially that emitted by an ordinary electric light bulb—is apt to confuse the junior chemist as to when true comparison is obtained; further, it is invariably uniformly distributed, and can easily lead to uncertain and inaccurate results. Bright sunlight or deep shadow should be avoided. If standing in front of a window, one should see that the shadow thrown by a wall or other opaque

bodies do not strike one tube only. The safest plan is to interchange the position of the tubes while comparing, so that the right-hand tube becomes the left, and *vice versa*, until the intensity of colour for the standard and sample are similar; this is obtained when the left-hand tube—even on interchange—is slightly darker than the right. With carbon contents above 0.2 per cent. this point is not difficult to detect.

The volume of the sample is read off, divided by thirty, and the quotient equals the percentage of combined carbon.

Carbon Bath Details.

The carbon-manganese estimation bath shown in Fig. 7 will be found a very useful piece of apparatus when a quantity of carbon and manganese determinations are made; it is far more useful than employing beakers, and it will obviously outlast many at a trifle the cost, while at the same time standing rougher usage. The bath itself is made of stout copper sheet, and it measures overall 14 in. × 4 in. × 7 in.; it is mounted on an iron stand 6 in. high. The interior, sides, and ends of the bath are fitted with ½-in. ledges, fixed at about ½ in. from the top; the ledges carry the carbon and manganese tubes' rack, which is removable by lifting with handles, B. The rack is perforated with twelve holes, each sufficiently large to permit the carriage and removal of ⅝-in. dia. test tubes, and nine or ten holes large enough for the manganese tubes, *i.e*, slightly over 1 in. dia. Ledge A has slits cut in at distances of 3 in.; these carry copper slip plates, dividing the tank into four parts, so giving spaces for the manganese flasks.

Heating is brought about by the aid of two ¾ in. × 5 in. "teclu" burners.

To facilitate removal of the tube, each one is fitted with an umbrella ring or piece of rubber tubing, so that about ¾ in. of tube is above the rack top

Estimation of Manganese by the Persulphate Method.

This method is an ideal one for grey iron foundry laboratories. Its simplicity of operation, rapidity, and accuracy leave little to be desired, and for regular testing it has several advantages over the bismuthate method, it being more rapid and less costly. The method described is quite suitable for irons containing up to 2.0 per cent. manganese. Strict adherence to details is essential for satisfactory results; for example, the writer found that for his particular practice accurate results are assured if the time of heating after the addition of the ammonium persulphate did not vary more than three seconds more or less than the standard time of thirty seconds; greater variations produced widely varying results. If the sample is found to contain much more than 2.0 per cent. by the persulphate method, a check estimation should be carried out, employing the bismuthate method. Details of the bismuthate method will be described later when dealing with the analysis of speigel, ferro-manganese, etc.; the only differing details when using this method for cast iron is that the weight of sample taken is 1.10 gr., so that each c.c. of ferrous ammonium sulphate will be equivalent to 0.10 per cent. of manganese. The determination is made on the whole of the sample solution, and the graphite is filtered off through filter paper pulp.

Reagents Required.

Nitric acid, dilute 1-1 solution. *Silver nitrate*, 1.7 gr. dissolved in 500 c.c.s. water. *Ammonium persulphate*, 50 gr. dissolved in 250 c.c.s. water. The bottle should have a well-fitting stopper, and no more than a fortnight's requirements of this solution should be made up at one time, owing to its tendency to decompose fairly rapidly.

Sodium Arsenite, Stock Solution.—Weigh into a 400 c.c. squat-form beaker 4.90 gr. of arsenious acid and 25 of sodium *bi*-carbonate, add 200 c.c. water, and boil for 10 to 15 minutes; cool to normal temperature, and filter through a No. 1 Whatman into a litre flask; dilute to exactly 1,000 c.c.s. with water.

Sodium Arsenite Solution, for Titrating.—Pipette 100 c.c.s. of the stock solution into a litre flask, and dilute to the mark. One c.c. of this solution equals approximately 0.070 per cent. of manganese on a 0.2-gr. sample.

Method Described.

Weigh out into a *clean, dry* test tube (6 in. × 1 in.) 0.2 gr. of the sample; into another tube weigh a standard. If the method is properly standardised it is unnecessary to do a standard for each series of daily tests; one standard a week will suffice, providing, of course, that the same solutions are in use throughout that period.

To each sample or standard contained in the tube add 10 c.c. of 1-1 HNO_3, immerse the tubes in the bath, heat the bath water to boiling-point, and from this point time the immersion for 20 minutes, shaking at intervals to aid the escape of nitrogen oxides. If the water is boiling when the tubes are immersed, then heating should proceed for from 30-35 minutes. It is essential that nitrous fumes should be completely driven off, hence a timed period which will ensure this forms an excellent safeguard. The tubes are removed at the end of the period, and each test is filtered through paper pulp, and the pulp and residue is washed once with about 10 c.c. of 2 per cent. HNO_3 and once with water, adding the acid and water to the tube first. The filtrates are transferred to conical flasks of 175 c.c. capacity, the filter flask being washed out with a little distilled water.

Remove the perforated rack from the bath and insert the copper slip plates, then place the flasks containing samples, in the bath; heat the water to boiling-point. After the samples have been immersed for 5 minutes at boiling-point, shake, then to each add 10 c.c. of silver nitrate solution, then shake again. To one test add 10 c.c. of ammonium persulphate, remove the flask, and shake gently until the solution becomes a definite pink, immediately replace in the bath, and allow it to remain for 30 seconds, as indicated by an interval timer; remove the flask, and allow to cool thoroughly and rapidly, preferably in running water. The other tests are treated in precisely the same manner. It is of utmost importance that the tests should be treated in exactly the same way as the standard, especially in respect of the time they remain in the bath *after* the addition of the persulphate reagent.

Most text books advise the use of solid ammonium persulphate, owing to the instability of the salt when in solution, but careful attention to this point is unnecessary; a solution of the strength given will keep in good condition for at least a fortnight, but longer periods are not advised.

When the tests are quite cold, the standard is titrated rapidly with the sodium arsenate solution until the pink colour changes to just a definite green. The practice of adding a few c.c.s. of sodium chloride solution to the test before titrating, so as to prevent recurrence of the pink colour by precipitating the silver as chloride is, in the writer's opinion, not only unnecessary but inadvisable, especially when junior chemists are making the test, as the precipitated silver results in the "end point" being less sharp. Omitting the sodium chloride, yields, on rapid titrating, a very sharp and definite "end point," enabling one to titrate to an accuracy of 0.05 c.c. with ease.

The number of c.c.s. required by the standard is read, and the remaining tests titrated in the same manner. The gradual return of the pink colour in the tests after titration and standing a few minutes is of no consequence; it is not indicative of incomplete titration, it is merely the excess silver nitrate reacting to produce the primary reactions with the excess persulphate. The number of c.c.s. required by the standard are divided into the percentage of manganese it contains; the result is the percentage factor, which, multiplied by the c.c.s. required by a sample test, gives the manganese content per cent.

The Metric System in Japan.—The metric system became official in Japan on July 1 of this year, under a recent Imperial Ordinance which puts into effect a law passed in 1921, providing for the use of the metric system, with a view of gradually displacing the complicated Japanese weights and measures.

Midland Iron and Steel Wages Board.—The only news of importance at the meeting on the Birmingham Exchange on Thursday was the Midland Iron and Steel Wages Board announcement, which showed a sufficient increase in the average realised price to give the operatives 2½ per cent. increase in wages, which makes a 10 per cent. increase in the last three ascertainments. The output of the works has decreased.

New Norwegian Electric Pig-Iron Furnace.

By Frank Hodson and Dr. M. Sem.

Norway has ever been famous for the high quality and purity of its iron, but it was not until the year 1910 that it was produced commercially by electric furnace methods. The Tinfos Verk and Ulefos Jernverk installed simple monophase pit type electric smelting furnaces using coke as a reducing agent, and produced between them about 10,000 tons of pig-iron per year.

Details of the New Furnace.

Originally these furnaces were provided with two sloping shafts, one on each side of the carbon electrode, but these did not prove satisfactory, and finally the gases generated were allowed to burn or escape. The furnaces were anything but efficiently operated in this way, and little real progress was made until 1921, when the Norwegian Government decided to provide the necessary money for the running of an electric smelting furnace of 600 k.v.a. capacity, using the Soderberg self-baking electrode.

The size of smelting furnaces is not limited as with the earlier monophase furnaces, and they can be single, two- or three-phase. The Norwegian Government decided that the Soderberg electrode opened up possibilities of a new field for electric smelting of iron ore. The furnace was put into operation in July, 1922, and ran continuously until January 6, 1924. Mr. Tysland, formerly of the Tinfos Works, was in charge of the operation, and his preliminary report on the successful running of the furnace was made in Kristiania on February 13, 1924.

There are places in the United States, Canada, South America and countries rich in cheap hydro-electric power where coal and coke is expensive and ore plentiful which are watching such experiments as this with keen interest. The plant of the Compania Electro Metallurgica Brasiliera already has two large electric smelting furnaces in operation, and over 120,000 kw. of electric iron smelting furnaces are now operating in various parts of the world. Chile could make better use of her abundant iron ore and water powers than by shipping raw ore to American smelters. It is just a matter of education plus enterprising capitalists with the money for necessary plant.

During the running of the Norwegian furnaces all kinds of ore was used, concentrates, sinters and lumpy ore. In some cases the content of powdery concentrates was up to two-thirds without giving special difficulty. Both charcoal and coke was used as a reducing agent; the charcoal worked so smoothly that it was decided to try to make conditions difficult for smelting so that coke and coke breeze were used most of the time. During the test 1,300 tons of pig-iron was produced, of which one-third was sold to foundries and two-thirds to a steel plant for use in open-hearth furnaces. There was no difficulty in making the iron either grey or white. The furnace was a pit type furnace, with electrodes hanging vertically down into the furnace crater. The running was divided into three periods.

During the first period of test the furnace was run as an open pit furnace with one top Soderberg and one bottom electrode. The electrode was tried in various ways, and most of the standard Norwegian ores were smelted to grey iron. The electrode was charged with about 11 amp. per sq. cm. In the second period of the test the furnace was still an open pit type, but was provided with two top electrodes in series. During the third and most successful period of test the furnace was closed with a brick roof, provided with a charging shaft around the electrodes, and the gases were collected by pipes. The consumption of power, coke and electrodes varied with the different kinds of ores, of the coke and the coke breeze respectively, and also with the grade and kind of iron made. A fairly good ore gave the following results:—For each ton of pig-iron 2,600 kw.-hr., 380 kg. coke (of 85 per cent. C.) and 8 to 10 kg. of electrodes. It will be seen that these results compare very favourably to what is being done in the large electric shaft smelting furnaces, and the operation and design of the new furnace is very much simplified.

A summary of the advantages claimed for this new furnace would include:—(1) Cheaper operation—two workmen ran the trial furnace; (2) cheaper and simpler installation—a 10,000-kw. furnace requires only three electrodes; (3) any raw materials may be used (powdered ore, iron sands, coke breeze, etc.); (4) load of the furnace can be varied as and when required; (5) can use charcoal or coke economically; and (6) Soderberg electrode operation continuous—no breakages, greater power input into furnace, increased production.

The first result of the experiment in the construction of a 4,000-kw. 3-phase furnace of this system by the Company Christiania Spigerverk, Kristiania, Norway. The gases collected from the furnace will be used in an open-hearth furnace.

Mixing Ore with Electrode.

Readers will also be interested in a new process of ore reduction that is being developed in connection with the Soderberg idea. This new method is applicable to both ferrous and non-ferrous metallurgy, and consists in making up the whole of the ore to be reduced in the form of composite Soderberg continuous electrodes. The ore is mixed with carbon in the form of pitch or tar, and is made into continuous electrodes. Current is passed through these, and the resistance of such electrodes to the passage of current drives off volatile gases, which can be collected and reduces the ore to metallic form. In the case of iron ore, the first product in the lower zone of the electrode is a pure carbon-free iron sponge, high in metallic iron. As the continuous electrode reaches the arcing zone of the furnace the iron sponge becomes pure molten iron with low carbon content. Practically all the heat put into the process is usefully employed, and the actual heat generated in the electrode can be readily controlled and regulated. The process may have far-reaching effects on iron, zinc, aluminium, and other industries.—"Iron Age."

Depression in Canadian Steel Industry.—A ninety-days' closing down of the British Empire Steel Corporation's steel plant at Sydney has been announced, to take effect as from August 9. The President, in making the announcement, said it was due to the severe depression arising from the lack of buying orders now general in the steel industry in Canada, like in the United States and Europe.

The British American Nickel Corporation, which have extensive plants near Ottawa and at Sudbury (Ontario), have been placed in liquidation as a result of action taken by the National Trust Company in asking for a sale of assets, forming covering security for an issue of six million first income bonds, and the appointment of a receiver. Mr. Rhodes, president of the Corporation, says that plants employing 1,438 men will close down.

U.S. Electric Steel Production in 1923.—The production of steel castings from electric furnaces in the United States in 1923 totalled 235,958 tons, an increase of more than 50 per cent. over the previous record in 1920, while ten years ago electric steel casting amounted to less than 1 per cent. of the country's output. Alloy-steel castings from electric furnaces also broke all records in 1923, with a total of 29,054 tons. This is an increase of 64 per cent. over the previous high mark of 17,760 tons in 1922.

Chromite Deposits in Asia Minor.—An important chromite mine from which the Röchling firm obtains their ore supplies for their well-known chrome steel is being worked at Tshardy, near Kutahia, in Asia Minor. There are numerous minor deposits in the country, but so far they have not been exploited, due to want of convenient transport means to the seaboard. Some of the deposits are said to contain as much as 60 per per cent. of chrome-iron ore. The Germano-Osmanli Mining Company is working a fair deposit near Tshardy-Daghardy.

German Industries in Spain.—Apart from the Krupp plans for the establishment of iron and steel works and shipbuilding yards in Spain, German groups are negotiating in connection with various Spanish metal works and mechanical workshops in Northern and Western Spain, while plans are also being discussed by the German heavy chemical industry for the erection of German-owned works in Spain. Owing to the probable future economic situation in Germany, German industry will be obliged to rely on foreign markets to a greater extent than ever, even though the risk be run of an emigration of a certain number of skilled workers from the homeland.

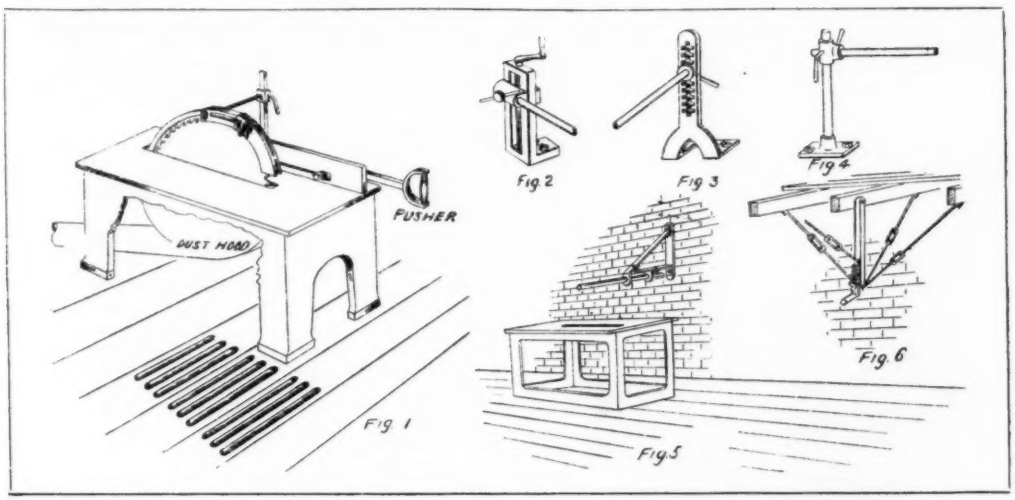
Safety Precautions for Woodworking Machines.

The Home Office have recently published* Safety Pamphlet No. 8, which contains a number of useful hints for patternmakers. The well-known precautions to be taken are admirably set out, and of the lesser appreciated ones, we have made the following abstract:—

Secure Foothold.

This is particularly needed beside such machines as the larger circular saws and planers, for when pressing the wood up to the machine the machinist's hands are near the cutters, and overbalancing in such circumstances has given rise to many accidents.

Brick, stone or concreted floors should be roughened from time to time and not allowed to become slippery. Wooden floors may have laths nailed down at intervals or suitable grooves may be cut in the floor boards, but thick battens liable to trip a person approaching the machine should be avoided. It is also undesirable to have loose grids, which may rock or slip. Fig. 1 shows a suitable arrangement.



Riving Knives.

Riving knives are thin blades of steel placed at the back of the saw, their main function being to keep the cut open and thus prevent the wood being sawn from closing on the saw. Should the wood seize on the saw it is apt to be projected backwards with great force, endangering the life of any one working the saw or who happens to be in the line of flight. Quite heavy timbers have been flung considerable distances in this way, and have broken through substantial partitions. The riving knife is wedge-shaped in section, and its greatest thickness should be very slightly more than the thickness of the saw teeth, say, 10 per cent. wider. This is enough to keep the saw-cut open, without increasing the effort needed to feed the wood up to the saw. The riving knife should be *curved* to the form of the back part of the saw. *Straight* riving knives, whether vertical or inclined, are unsatisfactory, for they leave a gap between themselves and the saw-blade, where hands may be badly cut and where rinds knots and loose ends of wood may be caught up in the teeth of the saw and thrown in the face of the sawyer. Moreover, they are less efficient in their function of keeping open the saw-cut, for they fail to enter the cut, at once, at the point (usually the upper edge of the plank) where the sawn timber first begins to leave the saw. Riving knives, curved to the saw, and closely set, say, within $\frac{1}{2}$-in. of the saw-teeth, have none of these disadvantages.

Circular Saw Crowns.

For the *crown of a circular saw* (by which is meant the top part of the saw, about one-sixth of its total circumference) a great variety of hoods and covers are available. Many of these are cumbrous and far larger than necessary. Clumsy appliances create a good deal of prejudice against the use of guards, and the greatest care should be taken to adopt only efficient types of guards, compact and neatly fitting. An inverted "U," somewhat curved and with the sides deep enough to cover the teeth of the top part of the saw, is sufficient for the crown of the saw. If the cover is made deeper it prevents the saw from cutting to its full height above the table, when required. The crown cover may be supported over the saw in many ways. The commonest method is to attach a pillar to the top of the bench at a convenient part, usually at the back of the table in the middle or at one end. The pillar supports an arm which carries the crown cover across the bench. Provision is invariably made for some degree of vertical adjustment at the pillar, by a screw, or a slot or a sliding socket or other similar means.

The crown cover may also be supported by a bracket from a wall, or suspended from a beam overhead, or even in some cases (very small saws only) it may be carried by the riving knife.

Types of support for crown cover are shown in Figs. 2, 3, 4, 5 and 6.

It is convenient to incorporate some simple device (such as the slotted bolt-hole shown at the base of pillar in Fig. 7) which will allow the whole guard to be swung round clear of the saw for such occasions as sharpening or changing saws, without disturbing the adjustments in which the parts of the saw guard have been set. Thus, in Fig. 7, the pin attaching the upper end of the riving knife to the crown cover is withdrawn, and the two bolts holding down the base of the pillar are slackened for access to the teeth of the saw. The loosening of the second pin, which holds the riving knife below the bench, allows its withdrawal, where

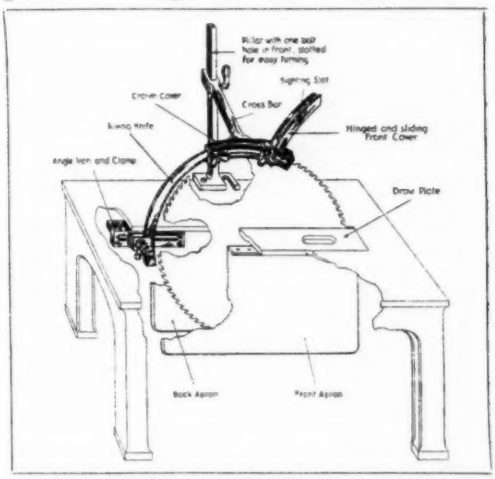


FIG. 7.—SUITABLE GUARD FOR BAND SAW.

* Fencing and Other Safety Precautions for Woodworking Machinery. Published by H.M. Stationery Office, Imperial House, Kingsway, London, W.C.2. Price 1s. net.

necessary, when the whole saw-blade becomes accessible.

A number of the hoods of sawguards on the market are pivoted, and swing up as the approaching wood lifts them. The drawback of such appliances is not that they fail to give protection, but that they are apt to be cumbrous and to impede the full use of the saw.

The simplest and most efficient system for general use is that shown in Fig. 7, where the crown cover is not large, is set more or less permanently, and is supplemented by a sliding front cover quickly adjusted to the different thicknesses of wood to be sawn.

Mechanical Feed Systems.

Mechanical (or "automatic") feed systems are coming into more extensive use for repetition work, as in boxmaking. These chain or reciprocating feeds have the advantage from the safety point of view of keeping the attendant at a safer distance from the saw. Fig. 8 shows a mechanical feed of good type.

In the pamphlet under review many types of saws are described and illustrated, but we would point out that a pattern-shop saw should be adjustable so as to cut grooves of any desired depth. This necessitates a movable or easily adjustable riving knife. The illustration, Fig. 8, appears to fulfil this requirement.

The great difficulty in woodworking machines, and particularly circular saws for pattern shop use, where the class of work is varied, is to get suitable guards, which are not clumsy, and which do not interfere

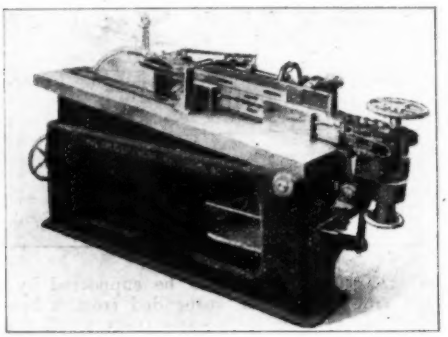


Fig. 8.—Mechanical Feed.—(W. & L. Cole, Limited, London.)

with the work, and therefore do more harm than good. Some of the illustrations in the pamphlet may be useful in a saw mill doing repetition work, but would be a nuisance in a pattern-shop. We consider the one we have reproduced (Fig. 9) to be good.

Bandsaws.

The Report points out that this saw, as a rule, runs over two (or three) light-spoked wheels in the near proximity of the operative.. The saw blade may break or come off and inflict serious injury, and accidents may also arise by contact with the revolving spokes of the wheels or with the saw. It is consequently essential that the saw blade and the wheels should be well protected. Fortunately it is easy entirely to cover with wire netting, wood or sheet metal (plain or perforated), the whole of the wheels and all of the blade except the part actually cutting.* The covers are usually hinged or work carries the guard up too. Fig. 10 shows a typical band-saw fencing.

Very large band saws, whether vertical or horizontal, are not free from these dangers which, in fact, are intensified, for a heavy band may work havoc when it breaks unless stout protection has been fitted around it. As travelling tables or feed rolls are necessary for leading the wood to the saw blade, there is less risk of contact with the blade just above the work than with the ordinary size of band saw. When feed rolls are used it is necessary to fit them with shields in order that hands may not be crushed between the fluted rolls and the timber.

Overhand Planing Machines.

These machines, known also as "surfacers," "jointers," or "buzz planers," are very dangerous owing to the necessity for handling the material quite close to the cutters, and have been responsible for many severe injuries to the hand. As a consequence of a knot or other irregularity catching in the cutters, the wood being planed is apt to be thrown suddenly backward out of the grip of the machinist, and his hand then falls upon the part of the cutter recently covered by the wood. Or, again, when the rear end of the wood is passing over the knives the fingers slip as they

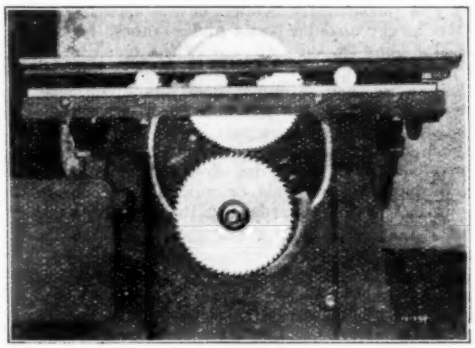


Fig. 9.—Method of Attachment of Riving Knives for Double Dimension Saw. Guard for Front and Crown of Saw is not Shown.—(Thomas White & Sons, Limited, Laighport, Paisley.)

are following it. In the first case described, if a "square" cutter block is in use, it is likely that all the fingers of the leading hand will be cut off at once, whilst in the second case the ends of the first and fourth fingers or the thumb of the following hand more usually suffer.

The "*square*" cutter block*—the earlier type used in planers is a rectangular block of square section, provided with two or four longitudinal slots by which thick knives are bolted on.

A "*circular*," "*safety*" or "*cylindrical*" cutter block is now obtainable from all the leading makers of such machinery. This block is completely cylindrical except for shallow clearances in front of each knife edge, and it is fitted with two, three or four thin knives, inserted in slots and held by

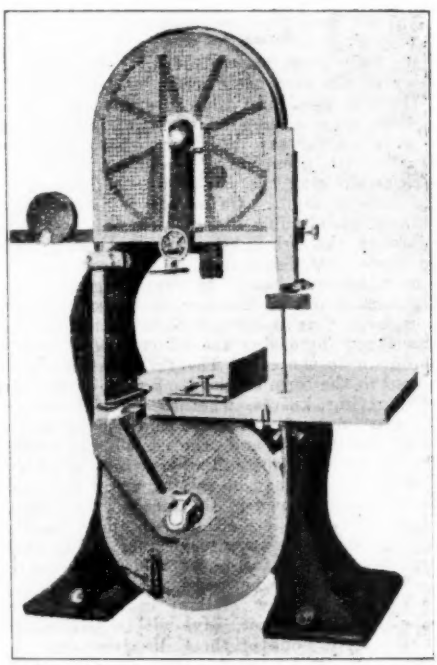


Fig. 10.—Bandsaw Fencing.—(Haighs, Oldham, Limited.)

screws, or attached by curved cover blocks. The knives being so much thinner can be made of finer steel and be sold more cheaply

* Required by Regulation No. 12.

* Forbidden since March 1, 1924, by Regulation No. 13.

than the blades for square blocks. Again, the grinding is more expeditious when the knives have to be re-sharpened. It is also claimed for circular blocks that they do smoother work and do it more rapidly. *Circular* blocks can be obtained either with the knives arranged spirally, or to give a straight shear in the usual way. In some of the earlier patterns clearances in front of the knives were faulty, and the block was apt to clog up with chips. Accordingly it is well for buyers of circular blocks to satisfy themselves that the pattern they select is free from this defect.

Removing the chips by pneumatic suction systems, mentioned later on, assists the machine and is of considerable advantage.

As there is far less space between the lips* of

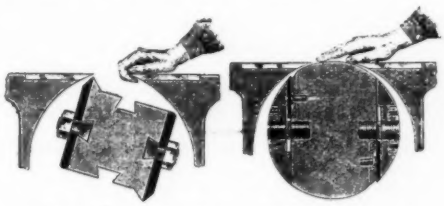


FIG. 11.—SQUARE AND ROUND BLOCKS.

the table and the block with the circular than with the square type, it is evident that the character of the injury inflicted is likely to be considerably less distressing with the circular block. This is found to be so in practice. The circular cutter block does not "refuse" at a knot so readily as the square block does, so that accidents are less frequent with it. The damage done by circular blocks does not often involve loss of bones, and is usually confined to the removal of "sixpences" of flesh from the tips of the fingers.

It is sometimes urged against the circular block that it cannot be used for rebating or moulding—tasks possibly better undertaken by circular saws, vertical spindle moulders, or three or four-cutter moulding machines. To meet this, certain makers have special arrangements in their circular cutter blocks by which a part of the cylinder can be removed when it is desired to use the moulding irons.

Fig. 11 shows sections of square and round blocks.

There is also a mongrel cutter block which has two curved and two flat surfaces. It is decidedly more dangerous than a true cylindrical block, and is not suitable for use on an overhand planer.†

Although the circular cutter block does not cause so many accidents nor such severe ones as the square block, the risk is not by any means negligible, and it is still necessary to use a guard with

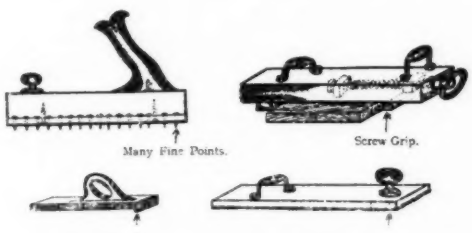


FIG. 12, A, B, C AND D.—PUSH BLOCKS FOR REPETITION WORK.

it. This should be of the "bridge" type,‡ which consists of a cover of some sort stretching over the gap in the table through which the cutter-block operates. The guard is usually a metal plate (possibly in two or more telescoping sections) or a framework of close-set rods, and it is essential that it should be capable of being rapidly adjusted both in height and across the table. If, for example, a plank 11 by 1½ ins. has to be both surfaced and edged, the "bridge" is raised to about 1¾ ins. above the table and set across the table to within about 1¾ ins. of the vertical guide. The plank can then be pushed flat over the cutters under the shelter of the "bridge" whilst it is being surfaced, and when this operation is completed the plank can be drawn back over the "bridge" and turned up on edge to be pushed over the cutters again between the vertical guide and the end of the "bridge" in order to plane its edge. The two operations can thus be performed with one setting of the guard. The "bridge" needs to be decidedly wider than the gap, otherwise, when raised to allow the planing of thick material, the degree of security conferred is materially diminished.

It should be substantially constructed in order to bear the strain of work being drawn over it on the return journey, when a second operation is to be performed on the same piece. To facilitate this process some "bridges" are fitted with a roller.

Push-block or Holders.

Push-blocks or Holders furnished with good handgrips are very useful appliances at overhand planing machines and should always be available. They are particularly required for holding short or thin pieces.* The under surface should have a suitable cleat or overlapping piece at the back, or should be studded with short spikes, such as the tips of tacks, or be covered with very coarse emery paper in order to engage with the work.

For some kinds of repetition work a push-block provided with a clamping arrangement may well be used. Figs. 12A, B, C and D show several sorts of push-block.

Lightning Planer.

There is a light type of *planer* in which short boards are smoothed by a *fixed* plane-iron, over

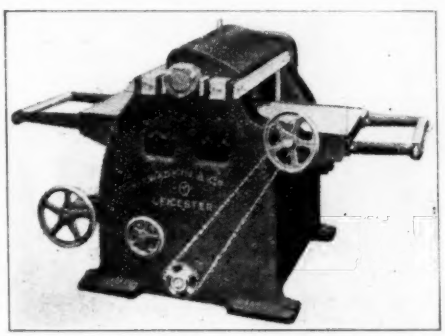


FIG. 13.—GUARDS FOR CUTTER AND FEED ROLLER OF PLANER.—(WADKIN & COMPANY, LEICESTER.)

which they are fed by a revolving rubber-covered drum.

Danger does not arise in this machine from the planing blade, but the feed roller should be fitted with a hood, the lower edge of which should just be clear of the work. Fig. 13 shows a suitable guard for feed rollers.

Spindle Mounting.

The vertical spindle-moulder or shaping machine is one of the most dangerous tools in common use. It causes a large number of accidents yearly, and a considerable proportion of these result in the loss of several fingers. As with circular saws and overhand planers the reason lies mainly in the operative's hands being constantly in close proximity to rapidly moving edge tools. The fingers come into contact with the cutters, especially when the work is violently torn from the machinist's grasp in consequence of some irregularity catching in the cutters. The fatal accidents are caused by cutters breaking off or coming loose, and being hurled away with great velocity, due to the centrifugal force developed by their exceptionally high speed. 1 to 7,000 revs. per min. It is therefore of prime importance that suitable safeguards should be chosen for each operation* and that cutters should be set with scrupulous care.

The Report then describes and illustrates three types of cutter block—the square block, the collar spindle and the French spindle.

Most of the devices shown for the rendering of them safe are good, but the spindle moulder is only used to a limited extent. They are usually replaced by the much more useful "pattern-making machine"—an adaptation of a milling machine. It may, under certain circumstances, be equally as dangerous as other types of woodworking machines, but the

* It is an advantage to fit steel lips to planer tables, in order to keep the gap as narrow as possible and to lessen the risk of pieces of the edge breaking off, leaving the width of gap irregular.
† Forbidden since 1st March, 1924, by Regulation No. 13.
‡ Required by Regulation No. 15.

* See Regulation No. 14.

Report apparently does not contain any reference to this machine.

Exhaust Ventilation.

Exhaust ventilation or pneumatic dust-removal systems have many advantages in woodworking establishments. They lessen the fire risk and render the likelihood of a dust explosion more remote. They save the labour of shovelling and sweeping up wood débris by delivering chips and dust at a central collecting point, where the refuse may conveniently be bagged up, or where it may be used to produce power, either being burned in a boiler or in a suction gas producer.

They diminish the risk of accidents caused by flying chips, and by keeping the air clearer enable the worker better to see (and so to avoid) the danger points. The discomfort caused by a constant bombardment of face and clothing by particles of wood thrown off by machines harasses workers and makes them less fitted to avoid danger.

They help to maintain vitality and to prevent injury to health from inhaling dust, by keeping the air supply free from fragments of wood and earth. The irritation and eczema set up by certain woods is also avoided. They prevent contact with cutters to this extent—that the collecting hoods must necessarily shroud a good portion of the danger area. Some firms consider that they receive a better return on their outlay for dust-

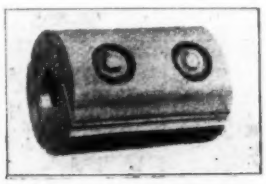


FIG. 14.—CYLINDRICAL OR "SAFETY" CUTTER BLOCK FOR SPINDLE MOULDER.—(I. SAGAR & COMPANY, LIMITED, HALIFAX.)

removal plant than on the capital otherwise laid out in their business.

General information on the important subject "Ventilation of Factories and Workshops" is contained in a Home Office pamphlet so entitled, but the special problems of removing dust such as that made in woodworking are beyond its scope. The installation of suitable appliances should be entrusted to competent ventilating engineers, most of whom are prepared to guarantee that their work will secure satisfactory results.

In judging between competitive estimates for any particular piece of work, points which should receive consideration are:—

(1) The relative amounts of horse-power required to operate the rival installations—an important consideration, as the power expended in driving the plant is an annual charge.

(2) The thickness of the piping employed (the life of the job will depend largely on this).

(3) The facilities provided for keeping the pipes clear; and

(4) The surplus accommodation in the piping, etc., available in the event of extension of plant.

The lowest tender is not necessarily the cheapest.

A point which should be borne in mind when designing hoods for collecting chips from tenoning machines, planers and spindle-moulders is that the material employed should be strong enough to be able to retain flying cutters, which come off with great force when they break or work loose.

No sand-papering machines should ever be worked without a dust-collecting apparatus, for in addition to the fine-wood flour, which it is objectionable to breathe, tiny particles of the abrasive are also cast into the air, and these particles are highly injurious when inhaled.

In an appendix to the Report "The Woodworking Regulations, 1922," are given, and we would draw attention to the following clauses of Part I—"Duties of Occupiers"—on account of their importance:—

(4) The floor surrounding every *woodworking machine* shall be maintained in good and level condition, and as far as practicable free from chips or other loose material, and shall not be allowed to become slippery.

(7) After March 1, 1924, no *woodworking machine* shall be worked in any *underground room* which is certified by the Chief Inspector of Factories to be unsuitable for the purpose as regards construction, light, ventilation or in any other respect.

(8) The temperature of any part of a room in which a *woodworking machine* is being worked shall not at any time fall below 50 deg., except where and in so far as the construction of the room and the necessities of the business carried on make it impracticable to maintain this temperature.

(13) After March 1, 1924, no *planing machine*, which is not mechanically fed, shall be used for overhand planing unless it is fitted with a cylindrical cutter block.

The Effect of Added Titanium on the Properties of Malleable Iron.

In a recent number of "Stahl und Eisen," E. Piwowarsky describes some experiments he has carried out to determine the effect of adding titanium to iron subjected to malleabilising.

The raw material used in the tests had the following analysis:—C, 3.38; Si, 0.49; Mn, 0.45 and S, 0.15 per cent. It will be noticed that this iron has a fairly high carbon content and a low silicon content; but the composition was intentionally selected with a view to determining the effect of titanium on the dissociation of the carbide and on the malleablising process. The melts were made in an electric furnace, the titanium being added in the form of a ferro-titanium produced by the Goldschmidt process.

The tests carried out comprised malleabilising tests and a micro-examination of the material. In order to get comparative results, the material was heated (1) in pure silica sand, and (2) in ore (spathic iron ore) as in the German process. The results of the tests may be summarised as follows:

The addition of titanium to cast iron is employed for malleablising a fine-grained structure, and gives a uniform distribution of the temper carbon in the material when malleablised. It accelerates the decomposition of the carbide and facilitates the burning out of the carbon during the malleablising process. The advantages of adding titanium are more marked in the case of the black-heart material than where annealing is carried out in ore.

Iron and Steel Output for June.

The National Federation of Iron and Steel Manufacturers, in their Statistical Bulletin for June, report that the production of pig-iron in June amounted to 607,800 tons compared with 650,900 tons in May and 692,900 tons in June, 1923; the June production was the lowest recorded in any month since November, 1923.

Steel production also registered a marked decline in June, amounting to 651,500 tons compared with 809,700 tons in May and 767,700 tons in June, 1923.

Production of both pig-iron and steel has been about equal to the production in the first half of 1923, but nearly 10 per cent. less than in the first half of 1920.

SIEMENS AND ENGLISH ELECTRIC LAMP COMPANY, LIMITED, in order to handle more expeditiously the increasing business in the Sheffield area, have removed their branch offices to larger premises at 30-32, West Bar, Sheffield. The whole of the premises are occupied by the company, and comprise a showroom and stores, large stocks of the company's products being held.

THE GREAT NORTHERN SECTION of the London & North-Eastern Railway have recently accepted the tender of Joseph Kaye & Sons, Limited, Lock Works, Leeds, for the supply of Kaye's patent railway carriage door locks, safety catches and handles, for the next twelve months. Messrs. Kaye also have received orders for 4,292 of the above to be fitted to the whole of the twenty-nine trains, consisting of 290 carriages, now being built for the Great Eastern Section of the company. Other orders include several from the London, Midland & Scottish Railway.

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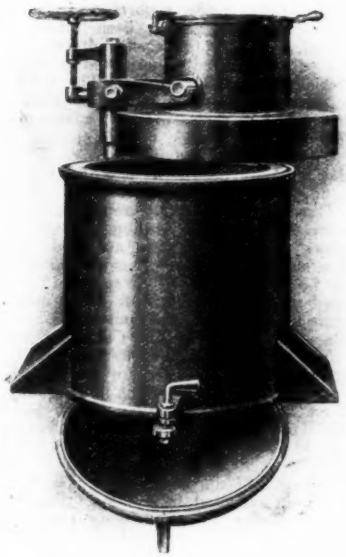

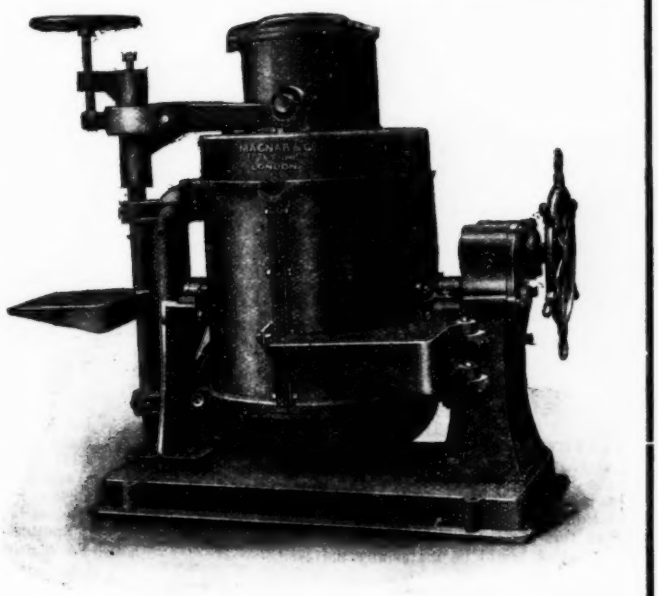

Tylor Patent Pit-Type Furnace.

OUTPUT.

200 lbs. Admiralty Gunmetal melted in 35 minutes. Temperature 2000° F.=1093° C.

ECONOMY.

25 lbs. of Coke used per 200 lbs. of Metal melted.

STANDARD CRUCIBLES.

Lasting 35 to 40 heats.

Tylor Patent Tilting-Type Furnace.

OUTPUT.

450 lbs. Admiralty Gunmetal melted in 50 minutes. Temperature 2000° F.=1093° C.

ECONOMY.

80 lbs. of Coke used per 450 lbs. of Metal melted.

STANDARD CRUCIBLES.

Lasting 30 to 40 heats.

56/8, EAGLE STREET, SOUTHAMPTON ROW, LONDON, W.C.1.

Works: TOTTENHAM, LONDON, N.17.

IRON AND STEEL MARKETS.

Pig-iron.

MIDDLESBROUGH.—Business having been virtually suspended over the holiday period, there are no fresh developments to record in the Cleveland iron trade, which continues in the same lethargic condition previously reported, with little prospect of a revival of home demand until later in the autumn. In this week's market there were far more sellers than buyers, and the small amount of business transpiring was usually on terms of negotiation, makers quoting about 85s. per ton for the standard No. 3 G.M.B. quality, with No. 1 on the scarcer side at about 90s. per ton, while No. 4's, whether foundry or forge, were nominal at about 84s. and 83s. per ton respectively.

In the Tees-side hematite market the volume of inquiry for home requirements was very moderate, and there is keen competition for any business that is passing. Export inquiry is lifeless, though there are shipments still going to Italy under current contracts. This week the quotation for mixed numbers was lower at 94s. per ton, but it is weak and can be shaded. On the West Coast, Bessemer mixed numbers are quoted nominally at 105s. per ton delivered at Glasgow, 110s. per ton at Sheffield, and 115s. per ton delivered at Birmingham.

LANCASHIRE.—The local markets for foundry pig-iron have been much more irregular than for some time, and very variable prices have been heard of. The demand here is very quiet, with buyers less inclined to buy more than is required for immediate use. Some sellers of Derbyshire No. 3 iron are still asking 97s. 6d. per ton for delivery in Manchester; but probably under pressure even these stronger sellers would now accept 96s. 6d., or perhaps even 96s. Some cheap Lincolnshire iron is being offered, and Northamptonshire iron, in spite of the heavy carriage, is competing in this district.

THE MIDLANDS.—Since last reported, the values of foundry pig-iron have again fallen, and Northants, Derbyshire and Staffs makers have been obliged to cut their figures, which brings them very near the slump prices of 1923. The orders obtained just recently have been of little moment, hand-to-mouth requirements being the rule, and only in a few cases has there been any forward buying, and nothing serious will take place until the end of next month. The following are the current quotations:—Derbyshire No. 3 foundry, 87s. to 88s. 6d.; Staffordshire No. 3 foundry, 87s. 6d. to 89s.; Northants No. 3 foundry, 82s. 6d.

SCOTLAND.—There is very little business to report, as the works are just getting under weigh now after the holidays. There have, in consequence, been few transactions recorded, with prices generally a shade weaker. No. 3 Scotch foundry is quoted freely at 93s. per ton at the furnaces, but for a round parcel this quotation could be materially bettered.

Finished Iron.

This was the most stagnant section of last week's market. There was nothing doing in any direction, and there will be a complete cessation of operations this week. So great is the depression that the firms who will be able to make a start at the beginning of the following week are more or less lucky. In the main they will be the marked bar houses, for though they are not finding conditions as good as they were at the beginning of the year, they continue moderately well employed. Crown iron makers have very little to do, and even those whose works are in operation find it rather a touch-and-go business to keep going. They have not had so lean and unsatisfactory a time within living memory. Even firms who, while not ranking with the marked bar houses, had a particularly good reputation, and in times past were kept constantly occupied on the production of very good class iron such as that required for marine purposes, are finding it impossible to keep their works regularly occupied.

Steel.

Many of the principal works in the industry having closed down for the holidays, very little interest is expressed in the markets for steel and its varied products, and actual business is at a minimum. Makers of semis at home are experiencing difficult times, Continental billets being freely offered at between £6 10s. to £6 15s. delivered the Midlands, and there are suggestions that that price is not always firm. It is rather difficult to say what the English billet price is. When asked, salesmen continue to quote £7 15s., but it is to be feared that it is only a bargaining price. Some firmness has again occurred in the tinplate market, which is attributed to the rising price of tin and the prospect of wage increases that are under the consideration of the Joint Industrial Council, and will be decided on the 11th inst. The rise in tin of £30 per ton since the last schedule price of tinplates is equivalent to 6d. in the cost of production of tinplates.

Scrap.

In all the principal markets for scrap metal business is on a very limited scale, with prices inclining to a weaker tendency. In Lancashire the demand for foundry scrap remains very poor, partly no doubt because the consumers are short of work, but also because foundry pig-iron is again weaker. Dealers still quote 87s. 6d. to 90s. per ton for the best lots of cast scrap, but, of course, it is well known that scrap can be bought at 85s. per ton, and there is too much of it waiting to find a market.

Metals.

Copper.—Increased interest has been centred on copper, with dealers in refined metal showing a stronger disposition to make purchases, while consumers in certain quarters have bought moderate quantities of electrolytic at advancing prices. Standard copper has fluctuated, but not heavily, closing fairly strong. American trade reports were more encouraging, good purchases having been made by domestic users, and, contrary to recent advices, the American stocks during June experienced a slight decrease to a little below 100,000 tons. The export movement from America looks like being maintained on a good scale, and producers are in a stronger position. *Cash*: Thursday, £62 17s. 6d.; Friday, £63; Tuesday, £64 5s.; Wednesday, £64 5s. *Three Months*: Thursday, £63 17s. 6d.; Friday, £63 17s. 6d.; Tuesday, £65 2s. 6d.; Wednesday, £65 5s.

Tin.—Messrs. Gardner & Company report a more active market, with higher prices ruling throughout. All week-end offers to America were accepted, and this, coming as a surprise to dealers, caused a rush of buying on the London market to cover sales. The level then reached has been sustained, with minor fluctuations. America has continued purchases, and a fair business has been done with the Continent and home markets. The Straits sold fair quantities daily, but there is no news from Batavia, where the Government hold for very full prices. *Cash*: Thursday, £247 15s.; Friday, £248 10s.; Tuesday, £256 15s.; Wednesday, £259 5s. *Three Months*: Thursday, £248; Friday, £248 12s. 6d.; Tuesday, £256 15s.; Wednesday, £259 10s.

Spelter.—The strength of markets and higher New York prices have been reflected in London. Reports from America show that efforts are being made to restrict output in the Joplin district, and this month's statistics are expected to show a further reduction in production. Meanwhile, under present trade conditions, any further substantial advance would seem improbable. *Ordinary*: Thursday, £32 5s.; Friday, £32 2s. 6d.; Tuesday, £32 8s. 9d.; Wednesday, £32 10s.

Lead.—The market for soft foreign pig has joined in the general tendency developed by other metals, and trading has been very brisk, with a large turnover in October and November positions. The threatened arrivals of Mexican lead do not appear to be materialising in any quantity, but the expectation of them has undoubtedly affected the demand for July, which has not been so keen of late. In consequence the backwardation has narrowed to 30s. *Soft foreign (prompt)*: Thursday, £33 10s.; Friday, £32 10s.; Tuesday, £32 15s.; Wednesday, £32 15s.

JOHN SUMMERS & SONS, LIMITED, are reported to have decided to close temporarily a portion of their steel plant at the Hawarden Bridge Steelworks, Shotton, Chester.

VICKERS, LIMITED, have just installed at their Barrow-in-Furness works a new open-hearth Siemens steel furnace of the very latest type, built and designed by Wincott's, of Sheffield. The capacity is between 10 and 20 tons per heat, and it is now possible to get a total output from the steel foundries at Vickers' Barrow works up to 300 tons of castings per week, ranging from a few pounds' weight each to a 20-ton casting. It is anticipated that a good proportion of the output will be absorbed for commercial castings. The first heat was tapped from this furnace on July 18, with very successful results, as determined from the test figures and analyses.